Reply Additional Details Sought for Rajmahal EC expansion proposal dated 27.02.2020

1. As per addendum EIA, it is mentioned that to fulfil the requirement of dispatch for 23.80 MTPA of coal, Farakka-Rajmahal part of MGR must have to be double lined and the number of NTPC rakes should also match the dispatch of 23.80 MTPA capacity of the mine on an average 22 nos. of rakes are to be dispatched daily from Rajmahal site. But enhancement of dispatch capacity requires building infrastructure including involvement of NTPC. So, clarity for the dispatch of extracted coal is required without available infrastructure and safety mechanism for extracted coal without coal transportation facility.

Reply: As per the mining plan, present despatch capacity through MGR system is 14MTY of coal through double lined Kahalgaon-Rajmahal Part of MGR and 6 rakes a day (approx. 6.50 MTY) from Farakka-Rajmahal part of MGR. Therefore, the present capacity of coal despatch comes to 20.50 MTY which is 85% of the proposed EC capacity. For despatch of balance production (2.30 MTY) doubled lined transportation arrangement is proposed in the Farakka-Rajmahal part of MGR.

2. Further, Elephants were found in the buffer zone (10 km) as some portion of it is occasionally visited by them, though it is not an elephant corridor. As elephant is an Schedule I species, Wildlife conservation plan duly approved by Forest Department is required duly approved by State Forest Department.

Reply: The Wildlife conservation plan has been prepared in consultation and under guidance of Divisional Forest Officer, Godda of State Forest Department. Approval of wildlife conservation plan is under process from competent authority of state forest department.

3. A formal letter of approval of Mine Plan and full document of Mine Plan including Revised Mine Closure Plan (considering expansion project) as part of Revised Mine Plan.

Reply: Formal approval letter of mine plan, including full document of mine plan is enclosed as Annexure-I. Mine closure Plan is a document of mining plan which is revised and updated.

29.02.2020

General Manager (Env & F)
Eastern Coalfields Limited

ईस्टर्न कोलफील्ड्स लिमिटेड
(कोल इंडिया लिमिटेड का एक सहायक संस्था)
अध्यक्ष-सह-प्रबंध निदेशक का कार्यालय
संकटोरिया,पो-दिशरगढ़ ज़िला-वर्धमान
प.बं.-713333 योजना एवं परियोजना विभाग
सी.आइ.एन -U10101WB1975GOI030295
वेबसाइट -www.easterncoal.gov.in
ई-मेल: eclplanning@yahoo.in

EASTERN COALFIELDS LTD
(A SUBSIDIARY OF COAL INDIA LTD.)
Office of the Chairman cum Managing Director
Sanctoria ● P.O - Dishergarh ● Dist - Burdwan
(W.B) – 713333 Project & Planning Department
CIN-U10101WB1975GOI030295
Website- www.easterncoal.gov.in
E-mail: eclplanning@yahoo.in

Ref. No. ECL/PLG/ 7918

Date: 29.02.2020

To,

General Manager (Env. & Forest)
Eastern Coalfields Limited
Barachak House

Sub: Minutes of the 325th Meeting of Board of Directors of ECL held on 26.09.2019

Dear Sir

Kindly find the attached Minutes of the 325th Meeting of Board of Directors of ECL held on 26.09.2019 in which Mining Plan for Rajmahal Expansion OCP(23.80 MTY) was approved under Point No. 325.03(T).

This is for your kind information and necessary action.

Thanking You

Yours Sincerely
29/02/2020
General Manager (P&P)
ECL

Enclosure: As mentioned above

Copy To:
1. CM (M), Plg, ECL

ईस्टर्न कोलफील्ड्स लिमिटेड
(कोल इण्डिया लिमिटेड का एक अंग)
अध्यक्ष-सह-प्रबंध निदेशक का कार्यालय
सांकतोड़िया, पोस्ट-डिसरगड़, जिला-पश्चिम बर्धमान
(प.ब). कंपनी सचिवालय, टेलिफैक्स:
0341-2520546.
सी.आई.एन: U10101WB1975GOI030295
वेबसाइट: www.easterncoal.gov.in

Eastern Coalfields Limited
(A Subsidiary of Coal India Limited)
Office of the Chairman-cum-Mg. Director
Sanctoria, P.O. Disergarh-713333
Distt. West Burdwan (W.B.)
Company Secretariat
Telefax: 0341 – 2520546
E-mail: eclcos17a@gmail.com
CIN-U10101WB1975GOI030295
Website: www.easterncoal.gov.in

Ref. No. ECL:CS:3(325-C)/02

October 23, 2019

सेवा में/To,
महाप्रबंधक (योजना एवं परियोजना)/
General Manager (P&P),
ई.सी.एल, सांकतोड़िया / ECL, Sanctoria.

महोदय/Dear Sir,

Sub. : **Minutes of the 325th Meeting of Board of Directors of ECL held on 26th September, 2019.**

Reproduced below is the relevant extracts from the Minutes of the 325th Meeting of the Board of Directors of Eastern Coalfields Limited, held on 26th September, 2019 with regard to the following:

"325.02(B) **Status of "On-going" Projects of ECL up to 31.07.2019.**

(i) Board noted the information as brought out in the agenda.

325.02(C) **Report on Capex on 31.08.2019.**

(i) Board noted that against a target of ₹ 170.00 crore of CAPEX till 31.08.2019 the actual CAPEX was ₹ 193.47 crore.

325.02(D) **Action Taken Report.**

(i) Board reviewed the Action taken report as brought out in the Agenda. Board further directed:

a. GM (E&M): To expedite the process of construction of additional 10 MTPA CHP with Silo at Rajmahal Area.

b. GM (Safety): To include Safety Audit as an integral part of Safety Measure. To conduct safety drive, use of Mission SuDESHH and surprise checking and if any lacunae is found, Area GM is to be held responsible.

c. GM (P&P): To smoothly implement the 100 days action plan strictly adhering to the timelines.

325.03(M) **Revised Timelines for completion of Intermediate Milestones for the Construction of Additional CHP with Silo (10.00 MTPA) at Rajmahal Expansion OCP (Project identified in 100 days program in respect of First Mile Connectivity)**

(i) Director (Technical) P&P requested to invite General Manager (P&P) to present the proposal. GM (P&P) apprised the Board that during meeting held on 27.08.2019, AS (Coal), MoC through Video Conferencing directed to revise the timeline for completion of Intermediate Milestones for the Construction of Additional CHP with Silo (10.00 MTPA) at Rajmahal Expansion OCP (Project identified in 100 days program in respect of First Mile Connectivity). Accordingly, all the activities were examined and revised with new timeline.

(ii) In view of the above and details as brought out in the agenda, Board after detailed deliberation directed GM (P&P) to re-examine the proposal and place in the next meeting of the Board and till such time the existing timelines are to be strictly adhered.

325.03(T) **Mining Plan for Rajmahal Expansion OCP (23.80 MTY).**

(i) Director (Technical) P&P requested to invite General Manager (P&P) to present the proposal. GM (P&P) apprised the Board regarding the Mining Plan of Rajmahal Expansion OCP (23.8 MTY). He apprised that Rajmahal Opencast Coal Project is located in the Godda District of Jharkhand. Rajmahal Opencast Project is being run in partial outsourcing mode as per the provisions of approved Project Report (PR) of 17.00 MTY. Under this option, part of Top OB (equivalent to existing departmental mine capacity) is proposed to be removed departmentally. Complete 17.00 MTY coal, intervening partings & bands and rest Top OB (beyond the departmental capacity) was proposed to be mined by outsourcing means. The project has attained the completion criteria and its completion report has been approved by CIL Board. The mine has achieved its approved target production of 17.00 MTY in 2018-19. Completion Report of this Expansion PR of 17.00 MTY has been approved on 25.01.2017 in the 351st meeting of CIL Board. Presently, Rajmahal OCP is running as an existing mine. He also apprised the Board that the proposal has been recommended by Sub-Committee of ECL Board on EAAP in its 43rd Meeting held on 26.09.2019.

(ii) In view of above, Board after detailed deliberation approved the Mining Plan for Rajmahal Expansion OCP (23.80 MTY) as brought out in the agenda."

Original papers/file(s) on the above proposals bearing **Item No. 325.02(B)** were delivered to your Department on 11.09.2019, those on **Item Nos. 325.02(C) & 325.02(D)** were delivered to your Department on 17.09.2019 and those on **Item Nos. 325.03(M) & 325.03(T)** were delivered to your Department on 24.09.2019.

This is for your information and necessary action, please.

भवदीय/Yours faithfully,

Rathak
23/10/19

(रामबाबू पाठक)
(Rambabu Pathak)
उप-प्रबंधक (वित्त)/कंपनी सचिव
Deputy Manager (Finance)/Company Secretary

MINING PLAN FOR

RAJMAHAL EXPANSION OCP(23.80 MTY)

(RAJMAHAL AREA)

EASTERN COALFIELDS LIMITED

AUGUST, 2019

Regional Institute-1
Central Mine Planning & Design Institute Ltd.
(A Subsidiary of Coal India Ltd.)
G.T.Road (West End)
Asansol-713 304.

CONTENTS

MINING PLAN FOR RAJMAHAL EXPANSION OCP

SALIENT FEATURES

SL.NO.	P A R T I C U L A R S	AMOUNT
1	Balance Mineable Coal reserves (MTe.)	185.50
2	Total OB quantity (M.cu.m)	396.72
3	Average Stripping Ratio (Cu.m/te)	2.14
4	Peak target of Coal production (MTe./Year)	23.80
5	Peak target of OB Removal (Mcum./Year)	50.50
6	Balance Life of Mine in years	9
7	Total no. of Village for Re-habilitation	13
8	No. Of Village already re-habilitated	6
9	Average GCV grade of Coal	G-13
10	Total Lease hold (Ha)	1978.00
11	Lease hold for Quarry Area (Ha)	1344.00
12	Land under Physical possession (Ha)	1516.94
13	Existing Manpower (no.)	2178
14	Fund of Approved Mine Closure Plan (Rs. Crores)	207.22
15	EC Status	Revalidation as per EIA Notification, 2006 under process

Mining Plan of Rajmahal Expansion OCP (23.80 Mty)

1.0 INTRODUCTION

1.1 Background

1.1.1 Project Report for Rajmahal opencast mine was originally sanctioned in August, 1980 for a rated capacity of 5.0 MTY. The project was subsequently expanded to a rated capacity of 10.5 MTY, the PR for which was sanctioned in November, 1988. This PR was based on the project documents of Rajmahal-A OC Mine (10.5 MTY), prepared by METCHEM, Canada Inc. in Sept. 1987. Subsequently, a Revised Cost Estimate of Rajmahal OCP (10.5 MTY) was sanctioned by the government in July, 1993. However, the project has been completed in 1994-95 based on the project completion criteria circulated by the govt. and the project completion report has been approved by the ECL Board in June 1995.

1.1.2 The project was later expanded to a rated capacity of 17 Mty from 10.5 Mty with some modification of pit limit. This Second Expansion PR was sanctioned by the Govt. of India in September, 2009 for an additional capital investment of Rs. 153.82 Crores upto target year. Completion Report of this Expansion PR of 17.00 Mty has been approved on 25.11.2017 in the 351st meeting of CIL Board. The chronology of project approvals is summarised below:

Particulars	**Capacity (Mty)**	**Date of Approval**	**Sanctioned Capital (`Crore)**	**Remarks**
PR for Rajmahal OCP	5.00	Aug - 80	87.43	-
RCE for above	5.00	July - 85	217.27	Infrastructure modified to suit proposed expansion to **10.5 Mty**.
PR for Rajmahal Expansion OCP	10.50	Nov - 88	562.70 *****	1st expansion report based on project document (Sept.' 87) prepared by **METCHEM**
RCE for above	10.50	July - 93	966.70	Based on firmed up capital
PR for Rajmahal Expansion OCP	10.5 to 17.0	Sept - 09	153.82 *****	2nd expansion report
The PR of 17 Mty has been completed and presently running as an existing mine.				
*Capital sanctioned up to target year only. Additional capital was required beyond target year.				

1.1.3 The EC of the proposed 17 Mty Rajmahal Expansion OCP has received the under the EIA notification 1994 vide letter no.: J-11015/30/2004-IA II (M) dated 11.05.2005. However, as per the recent order of MOEF, EC of 17.00 Mty for Rajmahal OCP is to be revalidated under EIA notification 2006.

1.1.4 Application for ratification of EC of Rajmahal OCP under EIA notification 2006 has been made and TOR for the purpose has already been obtained. Preparation of EMP is under process. In the meantime Rajmahal OCP have achieved it targeted production of 17.00 Mty for the first time in 2018-19.

1.2 Present Proposal

It is now envisaged that the existing quarry has potential to produce at higher level by further outsourcing of coal and OB production without any change in other project parameters. Envisaging 40% capacity enhancement, this mine plan has been prepared within leash hold of approved EC for augmenting the capacity of mine to 23.80 MTY.

A revised calendar plan has been prepared for achieving a peak annual production capacity of 23.80 MTY on the back of higher level of outsourcing. The departmental resources shall be fully utilized. The higher productivity is likely to be sustained in future after land acquisition and rehabilitation is completed and the quarry can advance as envisaged in the project report.

1.2.1 As per the approval Rajmahal OCP (17.00 MTY) has been running in Partial Outsourcing option. Under this option part of Top OB (equivalent to existing departmental mine capacity) is proposed to be removed departmentally. Complete 17 Mty coal, intervening partings & bands and rest Top OB (beyond the departmental capacity) was proposed to be mined by outsourcing means. Salient features of Rajmahal OCP are as under:

Leasehold Area	:	1978 Ha
EC obtained for	:	17.00 MTY
Present production level	:	17.00 MT (2018 – 19)
Revised Capacity	:	23.80 MTY
Method of mining	:	Shovel-Dumper Surface Miner (for incremental coal Production)

1.3 Justification

Rajmahal Expansion OCP is projected for producing 17 Mty of coal and supply of the same to the power plants of NTPC. However, combined demand of Kahalgaon and Farakka STPS which are linked to Rajmahal OCP are 27.00 MTY. Hence, enhanced production from Rajmahal OCP will reduce the demand supply gap.

1.4 Project Site Information

1.4.1 Location

The Rajmahal Opencast Coal Project is located in the Godda District of Jharkhand, India, between latitudes 25^0 1' 12" N & 25^0 3' 15" N and longitudes 87^0 21' 0" E & 87^0 24' 0" E. The area is easily accessible, being connected with the Godda-Pirpaiti PWD road. The nearest railway station is at Pirpaiti on the Sahibganj loop of the Eastern Railway, about 30km from the project site. The topography of the area consists of a gently undulating surface, 70-100m above sea level, with the highest point, Lalmatia Hill, occurring in the northern part of the area at a height of 204m above sea level.

1.4.2 Climate

The area enjoys a mild to moderate and tropical to subtropical climate with temperatures varying between 8^0 C in winter and 48^0 C in summer. It is influenced by the monsoon from June to September and has an average rainfall of 1153mm per year (as recorded between 1958 and 1986).

1.4.3 Existing Status

The mine is being run in Partial Outsourcing mode as per the provision of approved PR of 17.00 Mty. In this arrangement part of Top OB (equal to departmental capacity) is to be removed departmentally. Balance OB removal and entire coal production is to be done by outsourcing. Outsourcing contract was awarded on the basis of assessed departmental capacity of approved PR. However, present departmental capacity is less than 50% of the assessed departmental capacity of approved PR due to timely non-replacement of 20 cum shovel and 170T dumpers. As a result additional outsourcing contract is being awarded to meet the short fall in departmental capacity.

The project has attained the completion criteria and its completion report has been approved by CIL Board. The mine has achieved its approved target production of 17.00 Mty only in 2018-19. Delay in achieving the target production is due to delay in rehabilitation of villages. Actual production from the mine since the approval of the 17.00 MTY PR is given below.

Year Wise Production Acheivement			
Year	**Coal (Mt)**	**OB (M.Cum)**	**Stripping Ratio (Cum/te)**
2009-10	11.26	16.35	1.45
2010-11	12.86	18.5	1.44
2011-12	11.53	13.89	1.20
2012-13	13.41	21.46	1.60
2013-14	14.32	23.23	1.62
2014-15	15.91	24.95	1.57
2015-16	15.55	34.41	2.21
2016-17	14.43	23.59	1.63
2017-18	14.86	18.86	1.27
2018-19	17.00	19.25	1.13
Total	**141.13**	**214.49**	**1.52**

The mine faces could not be advanced as envisaged in the approved PR due to problem in rehabilitation of villages and physical possession of notified land. As a result mine operation is being carried out with very steep mine profile with negligible coal exposure in the pit. This hand-to mouth situation does not augur well for mine envisioned to produce 23.80 Mty. For such a big mine a minimum pit inventory 2.50 Mt should be maintained and before onset of monsoon 4-5 Mt of reserves should be kept exposed.

Existing departmental infrastructure and facilities except coal dispatch system is sufficient to cater to the need of 23.80 Mty production. Additional HEMM required for proposed enhancement of production will be procured and maintained by Outsourcing agency.

In-pit crushing and conveying system envisaged in the approved PR could not be implemented due to various reasons. As an alternative, 4 no. of additional crushers have been installed at pit mouth by outsourcing agency to crush the ROM coal hauled from mines by dumpers. Crushed coal is conveyed to the ground bunker of main CHP from where it is conveyed to silos for loading to wagon. To augment the dispatch capacity another silo near the existing silos has been proposed to supplement the wagon loading capacity.

2.0 GEOLOGY OF THE BLOCK

2.1 Rajmahal Coalfields is a group of detached Geological Blocks, i.e. Brahmani being the southern-most, followed by Mahuagarhi, Pachwara, Chuperbhita and Hura (including Pirpainti Barahat) in the north. Although the blocks are isolated, there appears to be geological continuity.The Lalmatia block forms the northern most part of Hura coal basin.

The general stratigraphic sequence within the block is as follows.

Stratigraphic Sequence of Lalmatia Block			
Group	**Formation**	**Lithology**	**Thickness Range (m)**
Recent to Sub-recent	Alluvium	UNCONFORMITY	0-15
Upper Gondwana	Rajmahal Traps	**Rajmahal volcanics and inter-trappean sandstone and shales.** UNCONFORMITY	50
Lower Gondwana	Barakar	Coarse to medium grained sandstone with shale and coal	25-350
		Coarse arkosic sandstone, pebbly at places	15-150
	Talchirs	Sandstones and shales Tillites	10-20
		UNCONFORMITY	
		Granite gneisses, hornblende Schists and pegmatites	

Coal seams :

Twelve co-relatable coal seams have been deciphered from the borehole data within the block. These have been named as seam-I to seam-XII in ascending order. Out of these, five seams namely seam-V to seam-VIII and seam-XII show sporadic development seldom exceeding 1m in thickness. Seams IV to XII have been found only in areas south of Fault F8 which down throws southwards by 160m whereby preserving additional thickness of sedimentaries.

The general sequence of the coal seams with the intervening partings along with their thickness range is provided in the Table below.

Sequence of Coal seams		
Seam	**Parting**	**Thickness range (m)**
Seam-XII		1.27 – 2.10
	Parting	11.05 – 16.09
Seam-XI		1.75 – 5.74
	Parting	7.29 – 20.31
Seam-X		1.77 – 5.91
	Parting	3.85 – 21.93
Seam-IX		2.97 – 7.00
	Parting	2.97 – 9.70
Seam-VIII		0.68 – 2.99
	Parting	43.27 – 53.69
Seam-VII		0.56 – 3.28
	Parting	10.91 – 27.80
Seam-VI		0.40 – 4.20
	Parting	9.15 – 27.68
Seam-V		0.36 – 2.97
	Parting	11.40 – 41.50
Seam-IV		0.32 – 2.57
	Parting	Nil to 10.88
Seam-III		1.35 – 17.87

	Parting	Nil to 44.70
Seam-II(top)		1.47 – 17.10
	Parting	Nil to 26.52
Seam-II(bot)		10.96 – 26.53
	Parting	13.04 – 33.66
Seam-I		2.00 – 9.54

Note:

(I) Seams II (top) and II (bot) normally occur as two different seams within the Block except towards south where they combine.

(II) Coal seams also occur in the following combinations: (a) Seam-II (comb) + Seam-III (b) Seam-II (comb) + III + IV (c) Seam-II (top) + III (d) Seam-II (top) + III + IV.

2.2 As per the G.R 17 normal faults have been postulated within the block. Among these, five southward heading faults, namely Fault F1, 6, 8, 11, 13 and 15 are of major magnitude. As borne out of the interpretation, the southern half of the block (south of F-8 fault) is structurally more complex.

2.3 Description of Coal Seams

Seam-I (Combined)

The seam-I underlies seam-II (bot.) after a parting of 13.04m to 33.66m and is the lower most seam in the area. The seam has been encountered in 92 boreholes, out of which, in 25 boreholes the seam attains workable thickness which varies from 2.0m to 9.54m generally being 3m to 5.5m. The seam is best developed in the central and south central part of the block and split into two parts towards east, north, and west. The combined seam offers workable potential, while the split seams are normally of unworkable thickness except in some patches where it attains more than 1.2m thickness. The Mineability of the Seam-I needs to be further studied based on the data of additional drilling.

Seam-II (combined)

The seam underlies seam-III with a parting of 1m to 33.59m. The seam-II (comb.) has been intersected in 37 boreholes. The thickness of the combined seam including all bands varies from 21.03m to 40.51m. The thickness

excluding combustible bands of more than 1m thickness and all non-combustible bands irrespective of thickness ranges is from 15.35m to 37.89m, generally being 24m to 36m.

Seam-II (bottom)

The seam underlies Seam-II (top) with a parting from 1m to 26.52m. Seam-II (bot) has been intersected in 108 boreholes. The including band thickness of the seam varies between 10.96 m to 26.53 m. The thickness of the seam excluding bands of 1m and above generally varies between 10m – 16m.

Seam-II (top)

The seam underlies seam-III with a parting varying from 1m to 44.70m. The seam is intersected in 63 boreholes. The excluding band thickness of the seam usually varies from 7m to 13m.

Seam-III

The seam underlies seam –IV after parting of 1m to 10.88m. The seam has been intersected in 78 boreholes. The including band thickness of the seam varies from 1.35m to 17.87m. The excluding band thickness of the seam usually ranges from 5m to 10m.

Seam-III & II (comb) Combined.

As stated earlier, in south-western part of the block, the seam-II(comb) coalesce with overlying seam-III to form a single composite seam of thickness ranging from 36.64m to 54.88m including all bands . The usual excluding band thickness of the seam varies from 48m to 52m.

Seam-III & II (top) combined.

Seam-II (top) in two small isolated patches, combines with seam-III to form a combined seam which has been encountered in three boreholes namely, CM-049, CM-062 & CM-067. The thickness of the seam varies from 19.76m to 25.38m including all bands. The excluding band thickness range from 14.98m – 22.21m.

Seam – IV

The seam lies 114.6m to 136.20m below the next persistent overlying seam i.e. seam-IX. The seam has been encountered in 26 boreholes and its thickness varies from 0.32m to 2.01m though over major part, the seam is 1.5m to 2.0m thick. The seam has a very restricted occurrence towards southern part of the block. The seam is generally free from dirt band.

Seam-V, VI, VII & VIII.

These seams are not persistent and therefore offer limited exploitable potentiality. Hence, the details of these seams are not included in the GR.

Seams IX, X, XI & XII

These seams have limited occurrence in the deep mine area i.e. in the area between faults F8 and F15 (Plate-3). Seam –IX lies 3.85m to 21.43m below seam-X which again lies 7.29m to 20.31m below seam-XI. The usual thickness range of seam-IX is 4m to 6m and that of both seam X and XI are 3m to 5m. Seam-XII occurs in a very small zone with thickness 3m to 4m.Seam-XI is free from all dirt bands, while seam IX and X has Nil to 1 dirt band of more than 1m thickness. Seam-IX has nil to 1 non-combustible dirt band of less than 1m thickness, while seam-X has no such dirt bands.

3.0 GEOLOGICAL MODEL

The approved PR of Rajmahal OCP is based on the Geological Report on Lalmatia Block Prepared by CMPDI in 1984. During mine operation, field data has mostly conformed to the information provided in the G.R, except in the south of fault F8 i.e Deep Mining zone.

Mine operation in Rajmahal OCP revealed that alignment of Major fault F-8 along with minor fault F-10 is in slight deviation from that given in G.R. Extent of three more faults i.e F-6, F-11 and F-13 is found to be much shorter than the depiction of G.R. Moreover, field data shows that some additional faults i.e F-10A, F-10B and F-10C (shown in Geological Plan) have emerged in N-S direction from the fault F-8.

Incorporating these information from field operation, a fresh Geological model has been made for the Lalmatia Geological Block. This Mine Plan of Rajmahal Expansion OCP has been prepared on the basis of this fresh geological model. Geological plan on the basis of this model is shown in Plan no-1.

4.0 Quarry Boundary and Mineable Reserves

4.1 The plan showing quarry boundaries has been given in Plate-2. The Geological map with quarry boundaries is given in Plate-1.

The quarry boundaries of the proposed mine with enhanced production of 23.80 Mty is within the EC approved leasehold area for quarry i.e 1344 Ha. The proposed quarry boundary has been kept almost the same as the boundary envisaged in the approved P.R. (17.00 MTY) except in the following areas which has been included additionally. In some part of this additional zone, quarry operation has already been done.

i) In the northern side, a small part of Lalmatia hill along with adjoining area of Lohandia village and Lohandia Bazar.

ii) In the southern side a small part of deep mining zone including Bhorai village.

4.2 The OCP boundary for the proposed mine of 23.80 Mty will, therefore, is as follows.

a) **Northern Boundary**.

Almost upto the geological block boundary except in the north-east part.

b) Southern Boundary.

In the south foot-hills of Gandheswari hill forms the surface limit of the OCP. A part of the deep pit area which can be accessed from the existing mining front has also been included in the mine-take.

c) Western Boundary

The coal seams incrop in the west of the OCP and the existing quarry excavation edge in the incrop zone in the west automatically forms the limit of the present OCP.

d) Eastern Boundary

Eastern boundary, i.e. the dip side boundary of the OCP has been kept same as that of the approved 17.0 Mty PR i,e at coal: OB thickness ratio line of 1:5 at the floor of seam-II (bot) from where a batter has been drawn upto surface to form the surface limit of the OCP.

e) Quarry floor

As in the approved P.R. (17.00 MTY) floor of Seam-II (bot) has been considered as quarry floor.

4.3 Coal Reserves, Stripping ratio and Mine life

4.3.1 The mining zone has been divided into three areas as follows (Plate-3).

(i) Main mine area (zone of 17.00 PR in the north of Fault F_8)

(ii) Deep mine area (South of Fault F_8).

(iii) Lohandia zone (in the north, beyond the 17.00 MTY PR limit).

4.3.2 The Balance mineable reserves of the mine (as on 01.04.2019) has been estimated as follows.

Particulars	Mineable Reserves Within Proposed Mine-take (Mt)
Main Mine Area	*159.50*
Deep mining zone	12.00
Lohandia Zone	14.00
Total	**185.50**

4.3.3 The mineable reserves within the proposed mining zone as on 01/04/2019 has been estimated as 185.50 Mt corresponding to 396.72 Mcum of OB removal at an average stripping ratio of 2.14 m^3/te. These reserves include 14.00 Mt of coal from the Lohandia zone and 12.00 Mt from Deep mining zone at an average stripping ratio of 1.57 cum/te and 3.60 cum/te respectively. Majority of the balance mineable reserves at Deep mining zone is to be available from upper seams i.e. seam-IV and above whose occurrence are limited to this zone The seam wise mineable reserves & parting wise OB volume within the

different zone as on 01/04/19 has been assessed and presented in the following table

	Mineable Reserves (Mt)				
Sl. No	**Coal Seam**	Main Mine Area	Deep Mining zone	Lohandia Zone	Total
1	Seams-IV & Upper Seams	-	7.80		7.80
2	Seam-III	21.50	1.30	-	22.80
3	Seam-II(T)	63.07	-	6.4	69.47
4	Seam-II (B)/Comb.	74.93	2.90	7.6	85.43
Total Coal (M.tes)		**159.50**	**12.00**	**14.00**	**185.50**

Note: *Mining loss computed on the basis of 20cm loss on seam roof and 20cm on seam floor for all the mineable seams.*

Waste (M.cum)					
Sl. No	**OB/ Partings**	Main Mine Area	Deep Mining zone	Lohandia Zone	Total
1	Top OB	241.88	10.20	14.50	266.58
2	Intervening Parting Among upper seams	-	33.00	-	33.00
3	Part. Bet. Seam-III & seam-II(T)/II(T)&II(B)	72.88		-	72.88
4	Part. Bet. Seam- II(T)&II(B)	16.78	-	7.48	24.26
Total Coal (M.cum)		**331.54**	**43.20**	**21.98**	**396.72**
Av. Stripping Ratio(m^3/te)		**2.08**	**3.60**	**1.57**	**2.14**
Overall Stripping Ratio (m^3/te)		**2.14**			

Based on the above mineable reserves, the balance life of the mine has been estimated as 9 years (including 2019-20) if the mine capacity is expanded to 23.80 Mty. The life of mine may be extended by proving additional mineable reserves in the dip side in future.

4.3.4 Coal reserves has continued beyond the Lalmatia Geological block in its dip side. However, this reserves is of indicated category and need to be proved by additional exploration boreholes. After geological exploration, mine operation of

proposed mine plan can extend further the dip side using the existing infrastructural and other facilities.

4.4 Mineability of Seam I

Seam-I is developed in central and south-central part of the block and splits into two seams towards north-east, north and west. The seam has been encountered in 92 bore-holes, out of which, in 25 bore-holes the seam attains workable thickness of 2m and more.

In an earlier study (January, 2001) the mineable reserves of Seam-I was estimated to be 15.26 Mt and the volume of overlying parting was worked out as 51.22 M.Cu.m. The stripping ratio was estimated as 3.36 Cu.m/t. for seam-I and its parting only.

Additional drilling is required for proving the potentiality of the seam in terms of its occurrence as well as quality.

However, present position of the quarry and its in-pit dumping does not provide a viable option for mining seam-I.

5.0 MINING

5.1 Mining System

More than 95% of the minable reserves of this block is in Seam-III and Seam-II. Seams of upper horizon occurs mainly in the south of fault F-8.

5.1.1 Geological and Mining Charactristics

a) Usual thickness of coal seams:

Seam	**Thickness(m)**
Seam-XII	3-4
Seam-XI	3-5
Seam-X	3-4
Seam-IX	4-6
Seam-VIII	3-4
Seam-VII	1-2
Seam-VI	1-2
Seam-V	0.5-1

Seam-IV	0.5-1
Seam-III	5-10
Seam-III + II Comb.	37-42
Seam-II(top)	7-13
Seam-IIComb.	24-36
Seam-II(bot)	10-16

b) Min. & Max. Thickness of partings:

Particulars	Minimum	Maximum
Alluvium + Weathered rock	15m	35m
Top hard cover	15m	90m (approx.)
Parting between seam-III & II(top)	1m	44.00m
Parting between seam-II(top) & II(bot)	1m	26.50m
Intervening Parting among seams of Upper Horizon	1m	25m

c) Dip of Strata: Usually 2^0 to 3^0

d) Category of Excavation:

Coal	Cat. III
Alluvium and weathered rock or unconsolidated OB.	90% Cat. II + 10% Cat. I
Hard OB or consolidated OB & parting.	50% Cat. III + 50% Cat. IV

e) Volume Weight:

All coal seams considered (t/cum)	1.700
Alluvium (t/cum)	1.786
Waste rock (t/cum)	2.100

Considering the above Geological & Mining Characteristics, Shovel dumper system of opencast mining is presently in operation.

5.1.2 Type & size of main mining & transport equipment and their general deployment

a) OB removal

The parting between Seam-II (bot) and Seam-II(top) and the parting between Seam-II(top) and Seam-III is being removed by 10-12 m^3 shovel in combination with 100T rear dumpers. In the balance OB i.e consolidated OB and unconsolidated OB above seam-III, along with the above combination, 20 m^3 rope shovels in conjunction with 170 T upgraded (190T) electric wheel dumper will be deployed.

b) Coal production

Coal production is being done by 10-12 m^3 hydraulic shovel with 100T body dumpers. The coal dumpers will transport the ROM coal to the crusher house at surface. From there crushed coal will be conveyed to silo by conveyors for final loading to wagon. For additional 6.80 Mt of coal surface miner will be deployed and no crushing will be required.

c) Departmental HEMM

The population of major HEMM as per approved PR (17.0 MTY) vis-à-vis existing as on 01.04.2019 is given below

HEMM	As per approved PR (17.Mty)	Existing as on 01.04.2019
20cum ERS	5	5*
10cum ERS	3	2
12-14 DHS	3	3*
170T/190 Dumper	20	-
85T/100T Dumper	36	40^
311/250mm Drill	5	4
160mm Drill	3	3

410hp Dozer	19	18**
450hp Wheel Dozer	1	1
10cum FEL	3	1
28kl Water Sprinkler	6	5
280hp Grader	6	5

Note: * All ISO, ^4 no. ISO, **1 no. ISO

5.2 Partial Outsourcing Option

5.2.1 As per the approved PR, the mine is being run in Partial Outsourcing Option. In this option, top OB (of volume equivalent to the existing HEMM capacity) is being removed departmentally with the existing equipment i.e. by 10cum rope shovels / 12-14cum hydraulic shovels in conjunction with 100T dumpers. After replacement is available, 20cum shovel along with 190T dumper will join the fleet.

Complete 17 Mty coal, intervening partings & bands and rest Top OB (beyond the departmental capacity) is being mined by outsourcing means.

5.2.2 To achieve 23.80 Mty, additional excavation, both coal production and OB removal is proposed to be done by outsourcing. Additional coal production is proposed to be done by surface miner and OB removal is proposed to be done by 10-12 cum shovel in combination with 100T dumper.

5.2.3 With only 100T dumper and 10-12cum shovel available presently, mine capacity of Rajmahal has been assessed as 10.69 Mcum as on 01.04.2019. Hence, until replacement comes for 170T dumper and 20Cum shovel, major existing excavation load will be met through outsourcing. Entire additional excavation load for the proposed Mine Plan is envisaged to be outsourced.

5.2.4 Implementation of the mine plan involves increase of excavation volume by more than 40% resulting deployment of higher no. of HEMM within the same mining zone. In absence of in-pit conveying system, no of dumper for coal production will gradually increase as the mine advances towards dip side. In the

approved PR of Rajmahal Expansion OCP, 100T dumper in combination with 10-12 cum shovel was proposed even for outsourcing operation for the purpose of synchronization with departmental operation as well as limiting the no. of HEMM in the mine. In view of further increase in volume of excavation, safety aspect of the proposed mine plan demands that minimum size of HEMM for outsourcing operation should be 100T dumper with 10-12 Cu.m shovel. For coal production by surface miner, smaller size of dumper may be deployed.

5.3 Mining Method and Sequence Of Working

5.3.1 The OCP had been broadly divided into three areas namely main mine area, deep mining zone and Lohandia Mouza area (Ref. Plate-3). Deep mining zone is south of fault F8. Lohandia area is in the northern side beyond the pit limit of 17.0 Mty PR. Most of the reserves are in Main mine zone whose strike length has been gradually reduced towards the east side.

5.3.2 In the Main mine area, cover of top OB will gradually increase from 40m (present mine face position) to 90m (at the eastern limit). Combined coal thickness zone has been mined out and in the balance zone all the seams are split. Moreover, thickness of parting between Seam-III and Seam-II as well as between Seam-II (Top) and II (Bot) has been gradually increased towards dip side. Hence, cycle time for release of coal will gradually increase as the mine advances towards dip side.

5.3.3 This mining plan for 23.80 Mty has been prepared envisaging Basdiha village being rehabilitated within a year and the PWD road passing through the middle of the property is diverted at the earliest. To achieve 23.80 Mty, the mine need to be developed along its full strike length. The zone of Lohandia bazar (additionally included in this mine plan) also need to be mined out at the earliest to facilitate systematic in-pit dumping within the mine. For synchronized mine operation, workings of Lohandia zone need to be integrated with the workings of Main mine area at the earliest.

5.3.4 Deep mining zone (south of fault F8) has a separate mine entry. Some exposed coal of the bottom seam is still left in this zone. All the upper horizon seams

(seam-IV to Seam-XII) occur in this zone and some of them have been partly mined out. By extending the existing earth edge up to the leasehold limit in this zone, additional coal will be extracted from these upper seams.

5.3.5 However, before extraction of coal can start in this zone, ongoing re-handling job (to clear the debris of accidental dump slide) is to be completed to expose the left out bottom coal and fault plan of F-8. Before the accident, the mine working had reached upto (-) 89m R.L as shown in the existing plan (Plan no-2). Hence, mine haul-road has to be re-established for evacuation of left out bottom coal in this region.

5.3.6 Deep mining zone is highly faulted and have steeper seam gradient. Mining in this zone has to be done carefully keeping the mine faces across the faults. The recommendation of DGMS and High Power Committee in the aftermath of accident in Dec-2016 should be followed while working this zone. Actually small balance reserves left in this zone can supplement the production from Main mine area during the latter years when its strike length gets reduced.

5.3.7 In the Deep mining zone, Seam-II (Top) and (Bot) is combined. In the exposed zone, seam-II is partly mined out while the rest is covered under accidental dump slide. This left out coal of the bottom seam can be mined only after re-handling of the debris and exposing the fault plane of F-8. Fresh access road to this bottom coal also need to be established. However, entire exposed coal of bottom seam will not be mined out in the eastern side of fault F-10B (shown in Plan no-3) as access to the seam floor will not be possible due to narrow strike. In the up-thrown side of fault F-10, quarry floor will be left at floor of seam-III. Being the deep most part within a narrow area, bottom coal in this zone can be mined only during dry periods.

5.3.8 Majority of the mineable reserves of Deep Mining zone will come from upper seams i.e seam-IV and above. It is proposed that the bottom seam is mined first before mining the upper seams for ease of drainage and evacuation of upper

seams. Owing to narrow strike and difficult mining condition, level of production from Deep mining zone will be limited.

5.4 Mine Haul Road

Proper design and maintenance of mine haul road is essential to the smooth operation of an OC mine. Main coal haul road should be as straight as possible and at the quarry floor. However, due to haphazard in-pit dumping, major part of the coal haul road in the existing mine is above dump. Main coal haul road above dump has two negative aspects. In dry season it creates excessive dust and in rainy season it poorly affects the coal production. Hence it is suggested that in the remaining part of the mine coal haul road should be maintained at the quarry floor.

However, In the Deep mining zone, existing mine position does not provide the scope for maintaining coal haul road at the quarry floor except in the floor of seam-III (at the upthrow side of fault F-10).

For the Deep mining zone it is proposed that, exposed coal of bottom seam (i.e. combined seam-II) should be extracted first up to the maximum possible extent. Thereafter OB should be dumped at the northern half of the de-coaled narrow corridor up to the floor level of seam-III floor (at the upthrow side of fault F-10). This dumped corridor is proposed for utilizing as coal evacuation road for seam-III and upper seams of the deep mining zone. Southern part of the narrow void/passage should be treated as sump. (as Shown in Plan no-4).

5.5 OB Dumping

5.5.1 In Rajmahal OCP external dumping has been stopped prematurely and the land space envisaged for external dump has not been utilized for the purpose. At present, the prevailing mine position does not provide any scope for external dumping. Hence, entire OB removal during the balance mining operation has to be put in in-pit dump. And the height of In-pit dump will rise upto 80m above surface level to accommodate OB volume.

5.5.2 During the balance life of the mine about 396.72 M.Cum of OB will be removed. To rationalize the in-pit dumping, Lohandia zone need to be mined out very fast so that in-pit dump can spread along the full strike of the mine. Increased production from the same zone will result faster rate of OB removal and quicker formation of in-pit dump. Considering the very loose and soil type nature of the OB material in Rajmahal OCP, it is a matter of concern for the stability of the future in-pit dump.

5.5.3 Subsequent to the accident, triggered by massive dump failure in December 2016, several safety measures **(Annexure-I & II)** have been recommended by DGMS and IIT (BHU) for operation of this mine including in-pit dumping. One of the recommendation (though specific to the site of accident) was to restrict the internal dump height up to 70m from the coal floor.

5.5.4 However, this recommendation is not practicable for this mine plan, as accommodation of all OB material has to be done within the in-pit (quarried out area).And existing in-pit dump has already reached a height of more than 100m in the northern side. Another recommendation (though specific to the site of accident) of keeping the overall maximum dump slope within 15^{o} from the horizontal will also be difficult to maintain considering the volume of OB to be accommodated in-pit. Hence, another scientific study is suggested to find out the safe profile of in-pit dump in the places where dump height will be more than 100m from coal floor. Proposed final stage dump plan is shown in plate no-4.

5.5.5 In-pit dumping in the Deep mining zone is not possible during course of mining. Hence, almost entire 43.20 M.cum OB to be removed from this zone is to be dumped outside this zone. This OB volume can be accommodated partly in the in-pit dump of Mine area and partly in the western part of Deep Mining zone. However, space to be available in the west side of Deep mining zone is doubtful after accommodating the existing re-handling material from the accident site. Hence, in-pit dumping in the Main Mining zone will be severely stressed. Final void of Deep mining zone is proposed to be partially filled up by re-handling of OB from in-pit dump above surface level under the mine closure activity.

6.0 PRODUCTION SCHEDULE

6.1 The calendar plan of excavation has been formulated based upon the adopted sequence of mine development and optimum condition of mining operation for the entire life of the opencast mine.

6.2 Bulk of the production will come from the Main mine area. Two additional zones i.e. Lohandia and Deep mining zone will supplement the production to reach the target of 23.80 Mty. Target production is envisaged to be achieved in 2nd year of this mine plan i.e. in 2020-21.

The summarised calendar program of excavation is given below.

Production Programme For Balance Reserves				
		Coal (Mt)	OB(M.cum)	Stripping Ratio (cum/te)
1	2019-20	19.00	36.50	1.92
2	2020-21	23.80	46.40	1.95
3	2021-22	23.80	45.80	1.92
4	2022-23	23.80	50.10	2.11
5	2023-24	23.50	49.88	2.12
6	2024-25	20.50	47.50	2.32
7	2025-26	19.50	46.00	2.36
8	2026-27	18.50	45.00	2.43
9	2027-28	13.10	29.54	2.25
Total		**185.50**	**396.72**	**2.14**

6.3 **Zone wise contribution to achieve the targeted production is given below.**

Year	Main Mine Area		Lohandia Zone		Deep Mining Zone		Total	
	Coal (Mt)	OB(M.cum)	Coal (Mt)	OB(M.cum)	Coal (Mt)	OB(M.cum)	Coal (Mt)	OB(M.cum)
2019-20	18.00	34.50	1.00	2.00			19.00	36.50
2021-21	20.00	39.00	3.50	5.40	0.30	2.00	23.80	46.40
2021-22	20.00	39.00	3.50	5.60	0.30	1.20	23.80	45.80
2022-23	19.00	39.00	3.50	5.60	1.30	5.50	23.80	50.10
2023-24	19.00	39.00	2.50	3.38	2.00	7.50	23.50	49.88
2024-25	18.00	39.00			2.50	8.50	20.50	47.50

2025-26	17.00	37.50			2.50	8.50	19.50	46.00
2026-27	16.00	37.00			2.50	8.00	18.50	45.00
2027-28	12.50	27.54			0.60	2.00	13.10	29.54
	159.50	**331.54**	**14.00**	**21.98**	**12.00**	**43.20**	**185.50**	**396.72**

6.4 There shall be no change in the mining plan as envisaged in the approved PR (except inclusion of some quarry zone within approved leasehold). Only the rate of coal extraction shall increase to a level of 23.80 MTY. It has now been envisaged to enhance the production from the mine to 23.80 MTY by augmenting the outsourced production of coal and removal of OBR from additional zone within leasehold area.

After FY 2019-20, the mine will attain the desired capacity of 23.80 MTY. The remaining mine life at targeted capacity would be 9 years.

6.5 **Strategy for Capacity Enhancement**

As the PR has been approved in Partial outsourcing mode, any quantity beyond departmental capacity will be worked by hiring of HEMM. The enhancement in capacity will require more OB removal while the present departmental capacity is only 10.69 M. Cum / year. Thus, more outsourced machinery and manpower will be deployed to augment capacity for mining of both OB and Coal. Since the entire additional capacity will be outsourced, no additional capital is needed for procurement of HEMM.

Owing to shortage in departmental capacity (due to timely non-replacement of 20 cum rope shovel and 170T dumpers), additional outsourcing contract has already been awarded. It is envisaged that departmental HEMM be deployed in Top OB of Main mine area. For implementation of the proposed Mining plan, additional outsourcing contract in both coal and OB has to be awarded in all the three defined mining zones i.e Main mine Area, Lohandia zone and deep mining zone. However, additional outsourcing contract for the main mining zone is to be on short term basis as replacement of 170T dumpers and 20cum shovel is on the process.

Hence, along with the departmental operation, more than three outsourcing operations will be going on in the in the same OCP. For safe and successful implementation of the proposed mine plan, synchronization of all these operations is of utmost importance. Because, bench formation as well as part of dump space and haul road will be common to multiple operations.

6.6 Mine Development Job Required

Several villages within the balance mining zone need to be rehabilitated. Among them Basdiha and Lohandia villages is to be shifted immediately for implementation of the proposed mine plan. Another emergency requirement is shifting of the PWD passing through the middle of the property in the south of Basdiha village. Unless this road is shifted mine workings of the northern part, including Lohandia zone cannot be integrated with rest of the mining zone.

7.0 ISSUES CRITICAL TO IMPLEMENTATION OF THE MINE PLAN

Successful implementation of this Mine Plan depends on the contribution of production from the two additional mining zones included in the proposed quarry area. Higher rate of production from the Main mine Area will be impeded by Splitting of coal seams, gradual increase in thickness of intervening parting along with cover of Top OB and gradual reduction in strike length. Hence, simultaneous contribution of production from Lohandiha and Deep Mining zone (as shown in the calendar plan) is essential to achieve the target of this Mine Plan. Since, multiple outsourcing agencies will work along with departmental agency, synchronization of work among them is a vital requirement. However, following are the critical issues for successful implementation of the proposed Mine Plan.

a) Uninterrupted physical possession of notified land for unhindered advances of mine front.
b) Re-habilitation of all the villages as per schedule.
c) Diversion of the Borio-Lalmatia PWD road passing through the middle of the Main Mine area.
d) Safe Management of in-pit dumping.

e) Timely augmentation of dispatch capacity to match the production schedule of the mine plan.

8.0 COAL QUALITY

The office of the Coal Controller, 1, Council House Street, Kokata-1 in its annual declaration of Grade (Final) of ROM fractions of all seams of Rajmahal OCP, Rajmahal Area of ECL for the year 2016-17 has declared as G-13.

9.0 PUMPING & DRAINAGE

Dhulia nallah passing about 1 km. away from the North-Western boundary of the OCP in the dip side forms the main drainage channel of the project area. The major part of the mine water is discharged through Dhulia nallah which leads ultimately to the Ganges 30 kms to the North. Mine water passes through the settling pond before being discharged to the Dhulia nallah.

The rain water will be pumped out from main sump located in the main mine area along the Fault F8. From this main sump, lift pumps will pump out the water to the surface which will be discharged to the main drainage channel through garland drain.

10.0 COAL HANDLING & DESPATCH ARRANGEMENTS

10.1 Existing Rajmahal OCP has a CHP to dispatch 17.00 Mt of crushed coal. It is connected with Farakka and Kahalgaon STPPs of NTPC through MGR. Last year i.e. in 2018-19 Rajmahal OCP has despatched 16.93 Mt of coal to NTPC. In approved PR of 17.00 Mty, in-pit crushing and conveying system was proposed to minimize the no. of dumper and reduce the dumper transport within mine. However, the same could not be implemented and at present entire coal is being crushed at surface.

10.2 To manage the dispatch of proposed 23.80 Mt of coal as envisaged in this mine plan, additional arrangement for dispatch has to be made. As the additional coal is proposed to be produced by deployment of surface miner, additional crushing

arrangement will not be required. However, arrangement have to be made to augment the loading and carrying capacity of the dispatch system.

10.3 To augment the loading capacity, a proposal has been made for construction of an additional CHP comprising a silo of 10 Mty capacity along with over ground bunker near the existing CHP. The process for the purpose has already been started.

10.4 However, along with loading capacity, carrying capacity of the existing MGR has also to be enhanced. The Kahalgaon-Rajmahal part of MGR has been double lined and can transport upto 14.00 Mty of coal. But the Farakka-Rajmahal part of MGR is still single lined and cannot carry more than 6 rakes in a day. Hence, to fulfil the requirement of dispatch for 23.80 Mt. of coal as envisaged in this Mining Plan, Farakka-Rajmahal part of MGR must have to be double lined. However, the no. of NTPC rakes should also match the dispatch of 23.80 Mty capacity of the mine. On an average 22 nos. rakes are to be despatched daily from Rajmahal site.

10.5 Enhanced production is proposed to be achieved through hiring of HEMM. But enhancement of dispatch capacity require building of infrastructure including involvement of NTPC. Hence, timely augmentation of dispatch capacity commensurate with the proposed production schedule envisaged in this mine plan is an herculean task.

11.0 WORKSHOP & STORE

A main workshop along with the stores has already been constructed near the mouth of the access trench for daily maintenance, schedule maintenance, and repair of departmental HEMM deployed in Rajmahal OCP. A pit top workshop also exists for daily maintenance of dumpers, dozers, graders, water sprinklers and light motor vehicles.

Outsourcing agencies have their own workshop for maintenance of their HEMM. As additional excavation load will be outsourced, existing departmental arrangement does not need any augmentation.

12.0 POWER SUPPLY, ILLUMINATION AND COMMUNICATION

12.1 Existing power supply arrangement is sufficient to cater to demand of additional production. The main source of power is 100MVA, 220/132KV NTPC Substation at Dhankunda. Power is supplied to Rajmahal OCP from the existing 2 nos. of substations in the same premises given below:

1 x 20MVA, 132/33KV JSEB substation and,

1 x 35MVA, 132/33KV ECL substation

The other existing substations at various sites of the mine for power supply will continue to remain.

12.2 Illumination has been done at quarry and haul road, OB dumps, substations and mine site area by High Pressure Sodium Vapour lamps from the groups of lights installed on towers/poles. High Pressure Sodium Vapour lamps have also been used for street lighting. Power supply to additional lights have been envisaged from the existing system.

12.3 Telecommunication system for effective co-ordination and optimum utilization of men and material exists in the mine. Considering the safety, communication and automation requirement of the mine, additional requirement of telecommunication system has been assessed. Augmentation of the existing communication system is envisaged.

13.0 MINE SAFETY

13.1 Safety has been a major issue in Rajmahal OCP, especially after the accident of December-2016. It is possible that any unfavorably oriented structural discontinuity (shear plane/fault/s) may be present in the mining area, which could not be detected during exploratory drilling and it is detected during ongoing excavation. It may create unsafe mining condition. Recommendation made for Rajmahal OCP in its study report by IIT (BHU) for maintainability of mine and dump slope is proposed to be followed. Moreover, it is suggested that bye laws should be formulated and approved by DGMS for safe operation of the project wherever necessary.

13.2 Final pit slope of the proposed OCP has been planned as per the approved PR of 17 .00 MTY. However, as per the recent provisions of Regulation-106 of CMR 2017, method of working, ultimate pit slope, dump slope and monitoring of slope stability are to be planned, designed and worked as determined by a scientific study before starting of mine operation. Other provision of the Regulation-106 should also be followed during the operation of the proposed mine.

13.3 ***Stability of Benches***

It is suggested that stability studies be conducted for arriving at safe overall slope angle for high wall and also for dumps. This is particularly important in view of high dump heights proposed in the project and abundance of soil type materials in over burden. Continuous slope monitoring is essential to detect any instability in advance to safeguard against possible slope failure. The dump shall be regularly surveyed to produce up to date & accurate dump geometry.

13.4 ***Stability of In-pit Dump***

Before stating in-pit dump quarry floor should be made dry, by pumping out sump water. Top soil should not be put at the base of in-pit dump. Height of individual lift should not exceed 30m. As there are several incidences of dump failure in the mine, it is proposed that maximum safe height and slope of in-pit dump should be determined by scientific study.

13.5 ***Protection against Fire***

The coal available in the project is liable to spontaneous combustion and there is likelihood of presence of carbonaceous material in the dumps. Several incidences of fire have been occurred in mine faces and dumps. Therefore, regular checking for the signs of spontaneous combustion in coal benches/OB dumps will be necessary. Immediate measure has to be taken to deal with that fire.

13.6 ***Danger due to water***

There is no river/nallah near the project from where the danger of mine inundation may be expected. However, incident of inundation due to breaching

of garland drain (on the periphery of earth edge) has been occurred in the past. Hence, proper maintenance of garland drain, especially, during rainy season is essential.

13.7 *HEMM Operation and Hiring of HEMM*

Dumper haul roads within the mine have to be properly designed and maintained in good condition for plying of dumpers. Additional excavation load for this mine plan is proposed to be outsourced. Hence, additional fleet of Outsourcing HEMM will ply in the mine. For synchronization of mine working, size of outsourcing HEMM should be same as that of the departmental HEMM. Proper traffic rules has to be formulated, approved and enforced for safe movement of HEMM in the mine.

Safety guidelines prescribed by DGMS regarding deployment of hired HEMM and contractual workers in mine have to be strictly followed.

13.8 *Blasting*

Optimal blast design are to be used to minimize the adverse side effects due to blasting viz. noise, ground vibration, back-breaks, air blast and fly rocks etc. Whenever, blasting will be done within 300 m of any surface structure, road or any village/locality, controlled blasting will have to be done with permission from DGMS.

14.0 LAND REQUIREMENT

14.1 Total land requirement of the project has been worked out as 1978Ha (leasehold of approved EMP). Entire 1978.00Ha land has already been acquired under CBA and LA. Out of total requirement, 1516.94 Ha has already been possessed and 461.06Ha is to be possessed. Break-up of total requirement of land is given below:

Type Of Land	Total Requirement (Ha.)	Already Possessed (Ha.)	To Be Possessed (Ha.)
Tenancy Land	1715.21	1254.15	461.06
Govt. Land	155.37	155.37	-
Forest Land	107.42	107.42	-
Total	**1978.00**	**1516.94**	**461.06**

14.2 Break-up of total requirement of land for different purposes is given below:

Quarry Excavation (including safety zone)	1344.00 Ha
OB dump (including safety zone)	276.00 Ha
Township	120.00 Ha
Rehabilitation colony	42.00 Ha
Industrial site & Infrastructure	196.00 Ha.
Total	**1978.00 Ha.**

15.0 REHABILITATION OF VILLAGES

15.1 Eleven number of villages situated within and around the project were proposed to be rehabilitated in the approved PR. Majority of them have already been rehabilitated. Rest are under process. In this mine plan two more villages i.e Lohandia and Lohandia Bazar have been included within the proposed mining zone. Hence, these two villages have to be shifted additionally for this mining plan. Status of rehabilitation of all the villages is given below.

Sl. NO	Project Affected Villages (as per approved PR)	PAF(as per approved PR)	PAFs Rehabilitated	Rehabilitation status
1	Bara Simra	273	273	Completed in 92-94
2	Toyotola	34	34	Completed in 92-94
3	Dhowatanr	122	122	Completed in 95-96
4	Ghat Simra	45	45	Completed in 97-98
5	Charan Tola	169	169	Completed in 03-07
6	Bara Bhorai			
a	Kashi Tola	173	173	Completed in 01-02
b	Pradhan Tola	261	261	Completed in 03-05
c	Lohar Tola	272	272	Completed in 06-08
d	Daheranangi	52	52	Completed in 2008-09
e	Charan Tola(Dip Mining Area)	34	34	Completed in 2013-14
f	Dahar Tola, Mukhia Tola, Mem Tola, Bathan Tola &Abhi Tola	200	200	Completed in 2015-16
g	Bhado Tola(Muslim)	828	828	Completed in 2016-17
h	Bhado Tola(Santhal)	130	130	Completed in 2017-18

7	Chhota Bhorai	100	2	To Be Completed 2019-20
8	Bansdiha	1000	0	To Be Completed by 2020-21
9	Taljhari	500	0	To Be Completed by 2021-22
10	Paharpur	300	0	To Be Completed by 2022-23
11	Bheranda	300	0	To Be Completed by 2022-23
12	Lohandiha	325	52	To Be Completed by 2019-20
13	Lohandiha Bazar	773	0	To Be Completed by 2020-201
	Total	5931	2647	

16.0 MANPOWER

Total strength of manpower envisaged in the approved 17.00 Mty PR was 2618. Owing to non-implementation in-pit crushing and conveying system, requirement of departmental manpower will be less.

Existing strength of manpower in the Rajmahal Project is 2178 including 124 executives. Moreover, employment is be to be provided against physical possession of tenancy land. These additional employment in phases however will be offset by gradual retirement of existing manpower.

17.0 ENVIRONMENT

17.1 Rajmahal OCP is an existing opencast mine situated in Godda district, Jharkhand. EC for the mine was granted vide MoEF file no. J-11015/30/2004 – IA.II(M) dated 11.05.2005 for a peak production capacity of 17.0 MTY in a project area of 1978.0 Ha under the provisions of Environment Impact Assessment Notification, 1994 as amended on 04.05.1994 and 10.04.1997.

However, as per MoEF & CC Notification dated 06.04.2018, EC obtained under Notification 1994 is to be revalidated as per EIA Notification, 2006 and subsequent amendments. For the purpose application has been made and TOR obtained. Preparation of Draft EMP is under process.

In the meanwhile, an assessment was carried out by ECL for enhancing production capacity to 23.80 MTY within the approved project area. Accordingly, this Mining Plan has been prepared. This production enhancement will attract fresh EC under Clause 7 (ii) of EIA Notification, 2006.

In compliance of EC condition for Rajmahal OCP, routine environment monitoring w.r.t. ambient air, noise level, mine discharge and groundwater level & quality is being carried out by CMPDI. Results of the monitoring are given below:

17.2 **Ambient Air Quality**

a) Routine Environmental Monitoring w.r.t. ambient air and noise is being carried out on quarterly basis since Q/E June'95 at four designated stations. However, the monitoring schedule has changed from quarterly to fortnightly basis since September'16 onwards. The summarised data for air quality stations from April'18 to March'19 is shown in the following table:

Name of monitoring equipment & method used			PM_{10} Respirable Dust Sampler with Glass Micro fibre filter paper		$PM_{2.5}$ Fine Particle Sampler with PTFE Teflon filter paper		SO_2 Modified West & Gaeke Specto-photometer		NO_x Modified Jacob & Hocheiser Method	
Monitoring Location	No. of Samples Drawn	Category* (R- I, S)	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Mine Dispatch Building	24	R-I	36.8	114.3	34.6	57.9	<10	<10	13.8	26.8
CISF Camp	24	R-I	35.4	108.5	34.4	57.7	<10	<10	13.2	24.9
Urjanagar Hospital	24	R-I	31.2	91.8	30.2	44.4	<10	<10	12.8	20.8
ECL Rest House at Pirpainthee Market	24	R-I	30.5	98.5	30.0	44.1	<10	<10	12.7	22.8

*R-I = Residential, Industrial, Rural and other area;
S = Ecologically Sensitive area

Environmental Standards for Ambient Air Quality (AAQ):

Station Category	*Environmental standard for Raniganj Coalfield vide MOEF, Govt. of India, Gazette Notification No. GSR 742 (E) dated 25.09.2000 for 24 hourly samples at 500 meters from dust generating point*		*National Ambient Air Quality Standards (NAAQS), 2009 for industrial, residential and rural areas for 24 hours samples*	
	Pollutant Concentration (µg/m^3)			
	PM_{10}	**SO_2**	**NO_x**	**$PM_{2.5}$**
Industrial	300.0	120.0	120.0	60.0
Residential	100.00	80.0	80.0	

17.3 Water Quality

a) For the studies of water quality, samples of drinking/ground water and mine discharge from the following stations are being collected & analysed:

b) Mine water discharge locations

Sl. No.	Project	Station code	Name of Sampling Station
1	Rajmahal OCP	16MW1	OCP discharge water
2	Rajmahal OCP	16MW2	Discharge from CHP
3	Rajmahal OCP	16MW3	100 m upstream of Dhulia Nallah
4	Rajmahal OCP	16MW4	100 m down-stream of Dhulia Nallah
5	Rajmahal OCP	16MW5	Discharge from O & G at workshop

c) Groundwater / Dugwell locations

Area	Project	Station code	Name of the Station
Rajmahal	Rajmahal OCP	16GWL1	Dugwell at Bara Simra Rehab Site
Rajmahal	Rajmahal OCP	16GWL2	Dugwell at Higukita Village
Rajmahal	Rajmahal OCP	16GWL3	Dugwell at Lalmatia Chowk
Rajmahal	Rajmahal OCP	16GWL4	Dugwell at Lohandia Bazar
Rajmahal	Rajmahal OCP	16GWL5	Dugwell at Paharpur Village

d) Monitoring results are shown in the following tables:

GROUNDWATER QUALITY REPORT

Sl. No.	Parameters	Sample code & Date					Indian Standard Drinking Water (IS-10500 :2012)	
		16GW1	16GW2	16GW3	16GW4	16GW5		
			11.05.18	11.05.18	11.05.18	11.05.18	Desirable Limit	Permissible Limit
1	Colour, Hazen unit Max	Dry	3	2	5	4	5.0	15.0
2	Odour		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	
3	Taste		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	
4	Turbidity, NTU Max		2	1	2	2	1.0	5.0
5	pH		7.92	7.71	8.23	8.18	6.5-8.5	No relaxation
6	Total Hardness		344	360	396	368	300.0	600.0
7	Iron		<0.06	<0.06	<0.06	<0.06	0.30	No relaxation
8	Chlorides		141	142	167	146	250.0	1000.0
9	Res Free chlorine		0.05	0.07	0.04	0.06	0.20	1.0
10	Dissolved Solids		800	836	880	918	500.0	2000.0
11	Calcium		140	148	168	148	75.0	200.0
12	Copper		<0.03	<0.03	<0.03	<0.03	0.05	1.5
13	Manganese		<0.02	<0.02	<0.02	<0.02	0.1	0.3
14	Sulphate		94	90	78	74	200.0	400.0
15	Nitrate		8.80	10.80	8.36	6.80	45.0	No relaxation
16	Fluoride		0.43	0.32	0.40	0.48	1.0	1.5
17	Selenium		<0.002	<0.002	<0.002	<0.002	0.01	No relaxation
18	Arsenic		<0.002	<0.002	<0.002	<0.002	0.01	0.05
19	Lead		<0.005	<0.005	<0.005	<0.005	0.01	No relaxation
20	Zinc		0.03	0.03	0.04	0.03	5.0	15.0
21	Hex Chromium		<0.01	<0.01	<0.01	<0.01	0.05	0.05
22	Boron		<0.20	<0.20	<0.20	<0.20	0.5	1.0
23	Phenolics		<0.001	<0.001	<0.001	<0.001	0.001	0.002

Sl. No.	Parameters	Sample code & Date					Indian Standard Drinking Water (IS-10500 :2012)	
		16GW1	16GW2	16GW3	16GW4	16GW5		
			11.05.18	11.05.18	11.05.18	11.05.18	Desirable Limit	Permissible Limit
24	Alkalinity		240	208	224	232	200.0	600.0
25	MPN		NIL	NIL	NIL	NIL	Not Specified	
26	Cadmium		<0.0005	<0.0005	<0.0005	<0.0005	0.003	No relaxation

Note: All parameters are in mg/l unless otherwise specified

MINEWATER DISCHARGE QUALITY REPORT

Sl. No.	Parameters	Sample Code & Date					General Standards for Discharge of Effluent (Schedule VI)
		16MW1	16MW2	16MW3	16MW4	16MW5	
		05.09.18	05.09.18	05.09.18	05.09.18	05.09.18	
1	Colour	3	3	4	3	4	Unobjectionable
2	Odour	Unobject ionable	Unobjecti onable	Unobjecti onable	Unobjecti onable	Unobjecti onable	Unobjectionable
3	TSS	16	18	20	24	18	100
4	pH	8.23	7.69	8.23	8.36	7.52	5.5-9.0
5	Temperature(^{0}C)	30.7	29.7	29.2	30.8	29.1	Shall not exceed 5^{0}C above the receiving water temperature
6	Oil & Grease	<2.0	<2.0	<2.0	<2.0	<2.0	10
7	Total Residual Chlorine	<0.02	<0.02	<0.02	<0.02	<0.02	1.0
8	Ammonical Nitrogen	0.54	0.63	0.58	0.43	0.46	50
9	Total Kjeldahl Nitrogen	1.64	1.78	1.59	1.73	1.74	100
10	Free Ammonia	<0.02	<0.02	<0.02	<0.02	<0.02	5.0
11	BOD	12	16	22	20	22	30
12	COD	32	48	64	56	80	250
13	Arsenic	<0.002	<0.002	<0.002	<0.002	<0.002	0.2
14	Lead	<0.005	<0.005	<0.005	<0.005	<0.005	0.1
15	Hexavalent Chromium	0.04	0.04	0.03	0.02	0.02	0.1
16	Total Chromium	0.07	0.06	0.07	0.06	0.06	2.0
17	Copper	0.03	0.03	0.05	0.05	0.03	3.0

Sl. No.	Parameters	Sample Code & Date					General Standards for Discharge of Effluent (Schedule VI)
		16MW1	16MW2	16MW3	16MW4	16MW5	
		05.09.18	05.09.18	05.09.18	05.09.18	05.09.18	
18	Zinc	0.04	0.03	0.02	0.04	0.05	5.0
19	Selenium	<0.002	<0.002	<0.002	<0.002	<0.002	0.05
20	Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	3.0
21	Fluoride	0.34	0.42	0.28	0.36	0.24	2.0
22	Dissolved Phosphate	1.72	1.58	1.46	1.34	1.66	5.0
23	Sulphide	0.009	0.008	0.012	0.014	0.016	2.0
24	Phenolics	<0.001	<0.001	<0.001	<0.001	<0.001	1.0
25	Manganese	0.46	0.56	0.34	0.26	0.54	2.0
26	Iron	0.12	0.14	0.12	0.14	0.12	3.0
27	Nitrate Nitrogen	3.6	2.8	3.8	4.6	2.8	10
28	Cadmium	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	2.0
29	Total Dissolved Solids	250	588	336	302	366	Not Specified

Note: All parameters are in mg/l unless otherwise specified

Observations:

- General ground water quality in the area represented through well water have been found to be fresh with middle level of hardness, pH value slightly basic within quite normal range, less iron content, fluoride content within desirable limit. Other various parameters of the samples are found to be within the permissible limits.
- Mine water quality of mine has been found within the prescribed as per MoEF schedule-VI standard for effluent water.

17.4 Noise Level

4 noise level monitoring stations (common for ambient air quality) were fixed within the cluster to measure the level of day time work place noise as part of Routine Environment Monitoring. The location of these stations are given below:

Rajmahal OCP	
Station Code	**Name of Station (Workplace)**
16N1	Mine Dispatch Building
16N2	CISF Camp
16N3	Urjanagar Hospital
16N4	ECL Rest House at Pirpainthee Market

Noise levels were usually found within limits in the mining areas. The values ranged from 46.7 to 71.6 dB (A).

The Noise Pollution (Regulation and Control) Rules, 2000 in respect of noise for industrial, commercial, residential areas and silence zone:

Station Category	**(III) Limits for noise (Leq dB (A))**	
	Day Time (6am-10pm)	Night Time (10pm-6am)
Industrial	75.0	70.0
Commercial	65.0	55.0
Residential	55.0	45.0
Silence Zone	50.0	40.0

17.5 Ground Vibrations due to Blasting

Latest blasting techniques is adopted after studies conducted by the Blasting Cell of CMPDI to prevent and reduce ground vibrations caused by blasting in OC mines.

17.6 Land-use

Details of land-use within the project area of 1978.0 Ha as per the approved Project Report and EIA & EMP is given below:

Sl. No.	Land Use during Mining		
	Particulars	**Quantity (Ha)**	**%**
1.	Quarry	1344.0	67.95
2.	OB	276.0	13.95
3.	Township	120.0	6.07
4.	Rehabilitation Site	42.0	2.12
5.	Infrastructure	67.3	3.40
6.	Greenbelt	64.0	3.24
7.	Mineral Storage	26.0	1.31
8.	Road	6.92	0.35
9.	CHP	27.5	1.39
10.	ETP	0.5	0.03
11.	Tailing Pond	3.78	0.19
Total		**1978.0**	**100.00**

17.7 Flora & Fauna, Socio-economic Profile and other Parameters

As per the condition laid down in TOR issued by MoEF & CC for revalidation of EC, baseline data generation work is being carried out and the same will be incorporated during EIA & EMP Report preparation work.

18.0 MINE CLOSURE PLAN

18.1 Mine closure plan for Rajmahal OCP has been approved by ECL Board in 2013 with a fund of Rs.207.22 crores. Deposit to Escrow a/c is being made since 2013-14. Till 2018-19 Rs.88.55 crore has been deposited in the Escrow a/c. Salient features of this approved Mine Closure Plan is described below.

18.2 Mine Closure Plan has two parts. Progressive Mine Closure and Final Mine Closure Plan. The identified progressive mine closure activities shall be reviewed at the time of each 5-yearly monitoring of progressive mine closure plan. The last

2 year of mine life shall be covered under the conclusive final mine closure to be prepared 5 years prior to the intended mine closure for the approval of MOC. This final 5 year plan would carry all the details pertaining to progressive and final mine closure activities

18.3 Progressive Mine Closure Plan

18.3.1 Reclamation of External OB dump

In the initial phase of the mine, the OB had been dumped externally. Now, there is no plan to dump OB in external dumps. Several mitigation measures are being taken/would be taken for stabilization of external dump and prevent siltation and erosion, such as:

a. Toe wall and tow drain will be provided at the foot of the external dump.
b. A series of open drains to be provided on dump body to arrest surface run-off and prevent siltation.
c. After spreading the top soil, grass/ quick growing herbaceous plants shall be grown on dump slopes to minimise soil erosion.
d. In subsequent phase, the entire area shall be afforested in consultation with appropriate agency of State Govt./Forest Department.

Regular inspections of OB dump including the protective measures shall be carried out for ensuring its stability. Necessary remedial actions shall be taken as per the need.

18.3.2 Reclamation of Internal OB dump

Mining shall be carried out in a phased manner. As the mine will advance towards dip side, the de-coaled area on the rise side shall be back-filled, stabilized and reclaimed. The rate of progressive mine closure would almost match with rate of face advance. In course of back-filling, sufficient space will be kept between the moving face of the quarry and the toe of the in pit dump to ensure safety of manpower and machineries working in the OCP.

The internal OB dump shall also be stabilized and provided with adequate protection against erosion. After spreading top soil, initially, the surface area shall be planted with quick growing herbaceous plants to check the erosion. In

subsequent phase, the entire area shall be afforested in consultation with appropriate agency of State Govt./Forest Department.

18.3.3 Reclamation of redundant roads/drains/Settling tanks etc.

The redundant drains/settling tanks and other such areas shall be filled with inert material, appropriately graded and topped by at least 1 m of sub soil overlain by at least 100 mm of top soil. Finally the entire freed area including the surrounding area shall be planted with suitable species of plants in consultation with State Government agency suitable for the purpose. If concrete or brick wall has been used for such construction, it shall be ensured that no such material remains within 1.5 meters depth from the surface.

The redundant roads/areas freed from redundant coal stocks shall be loosened and topped with 100 m top soil, where needed. Finally the entire freed area including the surrounding area shall be planted with suitable species of plants in consultation with State Government agency suitable for the purpose.

18.3.4 Top Soil Management

Removal of top soil is a continuous process. The top soil is/shall be removed prior to drilling and blasting with due care to avoid degradation in the quality of top soil. At present, the removed top soil is concurrently being used for biological reclamation.

In future also, aim would be to use the removed top soil immediately for the reclamation of back-filled areas/OB dump/other areas to be reclaimed. This would avoid double handling of top soil, storage cost of top soil and most importantly the deterioration in the soil quality.

However, if the top soil is required to be stacked for longer period, more protective arrangements such as creation of embankments around the stack shall be made to prevent run off. Constant monitoring of soil quality shall be made. To prevent the degradation in the quality of top soil, natural fertilizers, soil conditioners and soil forming materials shall be used, if required. If there is fall in nitrogen levels, legumes shall be used to enhance the falling nitrogen levels in soil.

18.3.5 **Air Quality Management**

Following mitigation measures are being taken to control the air quality during mining operation:

- All blast hole drills are fitted with dust collection arrangements
- Water sprinklers are provided for dust suppression on haul roads and industrial area.
- Water sprinkling at the various points of the CHP, where coal is handled.
- Sufficient numbers of dust extractors are provided in CHP
- Creation of green belt along roads and plantation in vacant land.
- Proper maintenance of haul road and other transportation roads
- Transportation of coal by properly covered trucks/tippers
- If needed, some additional dust control measures like use of dust binder chemicals shall also be adopted at vulnerable places.

Further, the quality of air is also monitored on regular basis by drawing samples from the various residential and non-residential areas of the project. The test results are compared with the standards prescribed by the MOEF and if any deviation is detected, remedial actions are immediately taken to bring the AAQ standard within the prescribed limits.

18.3.6 **Water Quality Management**

The present/proposed mine water discharge details is as under:

a. Mine water is pumped out in a settling tank. Clean water coming out from the settling tank is used for dust suppression/other Industrial uses.
b. Excess pumped out mine water is allowed to flow into the surface water bodies after passing through settling tank.

c. Drains have been provided around the coal stock and OB dumps to collect run-off for diverting into settling pond before discharge into the natural water courses.

d. Garland drains have been provided to arrest surface run-off flowing in to mine pit.

Following water Quality protection measures are also being taken:

a. Industrial effluent treatment plant

b. Domestic sewage treatment plant

c. Intercepting drains to collect water from external dumps.

d. Provisions are being made to ensure that all the drains provided in the Colliery area discharge into properly constructed Sedimentation ponds. Water shall be allowed to leave the Project area only after it had passed through the settling tank. The size and design of settling tank should be such as to ensure retention of incoming water for sufficient period for facilitating settlement of suspended sediments.

Samples of mine water, drinking water and dug well water are regularly taken to keep an eye on the effects of mining on the water quality regime.

No cases of AMD have been detected in the area so far. However, a system of regular checks shall be installed for early detection of any potential source of AMD. If any such case is detected, such potential AMD material shall adequately be dealt with to avoid occurrence of AMD and subsequent contamination of surface and ground water.

18.3.7 **Restoration of Drainage pattern**

Dhulia nallah passing about 1 km. away from the north-eastern boundary of the OCP in the dip side forms the main drainage channel of the project area.

In course of mining, the minor disturbances affecting the drainage pattern is likely to be caused. Efforts shall be made to restore the normal drainage pattern as far as possible. If the restoration of original drainage profile is not feasible, efforts shall be made to achieve a drainage profile, which will ensure smooth drainage of the area with least possible surface erosion.

18.3.8 **Ground water management**

Ground water in the area occurs under both unconfined and confined conditions. The weathered mantle, recent alluvium and Latarite act as unconfined aquifer. The water table configuration coincides with the topography of the area.

Various options of ground water recharge, which are feasible in the area, shall be studied and adopted to recharge ground water. Some of the ground water recharge techniques, which may be adopted, are roof top rain water harvesting, ground water recharge through village tanks by de-silting them, proper use of existing de-coaled voids, constructing percolation tanks etc. The back-filled area would gradually restore the continuity of aquifers.

18.3.9 **De-commissioning of redundant Infrastructures**

Any structure (residential/non-residential), which becomes redundant for current or future use, shall be demolished. The useable materials shall be re-used, the recyclable materials shall be sent for recycling and the balance debris shall be appropriately disposed off. The freed area shall be cleared of contamination (spillage of hydrocarbon, explosives etc.), if any, before going for biological reclamation.

18.3.10 **Disposal of surveyed-off Machinery**

All machines, which have already been/will be surveyed-off and grounded, shall be removed from their area of use and placed at a proper place. It shall be ensured that there are no contaminant leakages from these equipment. All such equipment shall be auctioned as per Company's norms.

18.3.11 **Safety & Security**

While carrying out mining and allied activities in the OCP, all statutory rules and regulations in force will be observed and all appropriate safety measures would be taken. Circulars issued from time to time regarding safety of the personnel and equipment of the mine and to improve the working conditions of the mine would be adhered to.

The open cast area shall be kept securely fenced. As the mine would expand, it will gradually encompass more fresh land. Hence erection and re-erection of

fences would be required at regular intervals so that a sufficient distance is always maintained between the fence and the moving front of the OCP.

18.3.12 Plantation

Greenbelt around industrial sites, service building area and residential colony is being developed along with avenue plantation along roads. Plantation of trees on vacant land in project area is being/shall be taken up during various 5 year periods.

18.3.13 Entrepreneurship development Program

In order to ensure that these people do not suffer in the post closure period, the Project authorities in consultation with ECL (HQ) shall make efforts to develop entrepreneurial skills in the local people by imparting skill development/vocational training programs.

18.3.14 Maintenance of records pertaining to Progressive Mine Closure

The Mine management shall maintain a Progressive mine closure surface plan for every 5 year period up to mine life. This plan shall be maintained at a suitable scale showing the entire progressive mine closure activities (surface) carried out on yearly basis. The plan shall be updated on annual basis and shall be signed and approved by the appropriate authority.

A proper record of the executed progressive mine closure activities along with expenditures incurred shall be maintained at Colliery level. Such records shall be signed and approved by the appropriate authority.

18.4 Final Mine Closure Plan

18.4.1 Management of mined out area

By the end of quarry operation, most of the quarried out area will get completely backfilled and an area of about 200 Ha shall remain partially filled/ un-filled (small portion), which shall be developed as water lagoon. The exposed coal surfaces and benches of water lagoon shall be gently sloped, stabilized and reclaimed with plantation. Any exposed coal will be covered with waste material

to prevent spontaneous heating. The high-walls shall be properly sloped up to permanent water level with an aim to ensure stability of surrounding area. If needed, slope study shall be carried out to find out the right angle at which the high wall shall be sloped.

The entire void shall be kept securely fenced to avoid inadvertent entry of human and stray animals into it. The area surrounding the void shall be suitably vegetated. Danger signs shall be also be posted to warn the local users to stay away from the deep zone.

The back-filled area shall cover an area of approximately 1144 Ha. Major portion of the back-filled area shall be reclaimed in course of progressive mine closure itself. The balance back-filled area shall be reclaimed during post closure period in fashion as described in progressive mine closure plan. The entire external dump area shall be reclaimed in course of progressive mine closure itself.

Barring roads left for use of local people, all other temporary/permanent roads and any other disturbed areas shall be loosened and topped with at least 100 mm top soil, where needed, followed by plantation of suitable species of plants.

The usable infrastructures would be left for local/State agencies for use. Balance freed area after de-commissioning of redundant infrastructures shall be reclaimed and brought under green cover. Hence, the proposed post-mining land use plan will take a tentative shape, as depicted below:

Sl No	Land use Type (proposed)	Area (Ha)	Final Land use Type	Area (Ha)
1	Excavated area including haul-road	1344.00	Plantation on backfilled area	1144.00
			Lagoon	200.00
2	External OB Dump	276.00	Plantation on External OB Dumps	276.00
3	Colliery Infrastructure	196.00	Afforestation	91.00
4	Township	120.00	Undisturbed Area & others	267.00
5	Rehab Colony	42.00		
Total		**1978.00**		**1978** .00

18.4.2 Subsequent to closure of mining activities, the entire area shall once again be surveyed the drainage profile of the entire leasehold area would be modified and left in such a shape as to facilitate the smooth and normal run-off.

18.4.3 **Restoration of Ground water level**

After the cessation of mining, with copious rainfall and abundant groundwater recharge, the water levels will recoup and attain normalcy. Thus, the impact of mining on groundwater system may be considered as a temporary phenomenon.

The ground water level shall be monitored at regular intervals to check the rate of recharge. If needed, various options of ground water recharge shall be adopted to recharge ground water level. Some of the ground water recharge techniques, which may be adopted, are roof top rain water harvesting, ground water recharge through village tanks by de- silting them, proper use of existing de-coaled voids, constructing percolation tanks etc.

18.4.4 **Water Quality Monitoring**

The monitoring of water quality and other related aspects vis-a-vis remedial actions shall be continued, if required, for a period in excess of 3 years till an acceptable level of water quality is attained in and around the mine area.

18.4.5 **Air quality management**

Quality of air would be monitored for a period of 3 years after cessation of mining activity. The test results would be compared with the standards prescribed by the MOEF and if any deviation is detected, remedial actions would be immediately taken to bring the AAQ standard within the prescribed limits.

18.4.6 **Disposal of Buildings, Plants & Machineries**

Possibility of gainfully use all the HEMM, industrial infrastructure, railway siding, transmission line/ sub-station etc. by the company or the local body shall be looked into. Otherwise these shall be auctioned, dismantled and removed from the area. The freed area shall be cleared of debris/carbonaceous material/contaminants, appropriately loosened and topped with 100 mm of top soil, where needed. Finally the entire freed area including the surrounding area

shall be planted with suitable species of plants in consultation with State Government agency suitable for the purpose.

Possibility of gainfully use all the residential and non-residential buildings by the company, the local body or state authority shall be looked into. When there would be no takers, the buildings would be demolished and usable items would be recovered for future use. The debris shall be suitably disposed off. The freed area shall be cleared of debris/contaminants, appropriately loosened and topped with at least 100 mm of top soil, where needed. Finally the entire freed area including the surrounding area shall be planted with suitable species of plants in consultation with State Government agency suitable for the purpose.

18.4.7 **Safety and security arrangement**

A good portion of the quarry will be backfilled and the remaining void will be developed as water lagoon. The lagoon would be properly fenced to avoid any inadvertent entry of animals or human beings. Sufficient Boards and danger signs shall be placed all around. Later on, the responsibility of keeping the fencing secured would be entrusted on the State Authorities.

The exposed coal surfaces and benches of water lagoon shall be gently sloped, stabilized. Any exposed coal will be covered with waste material to prevent spontaneous heating. Vegetation cover will also be provided along the slopes to arrest any failure.

18.4.8 **Emancipation from the community facilities**

The local communities are being provided many civic facilities, such as educational facilities, health facilities, and drinking water by the mine management. One of the objectives of the present closure plan is to ensure that such facilities do not get discontinued after the mine closure.

In course of mining, several local people of the vicinity get indirectly engaged with the mining and other allied activities and thereby obtain financial benefits for livelihood of their families. One of the primary aims of this closure plan is to ensure that these people keep getting sustainable incomes for their livelihood even after the closure of the mine.

In view of the above, some skill development programs under guidance of dedicated NGOs would be conducted at regular intervals as part of progressive mine closure plan activities.

18.5 TIME SCHEDULE FOR MINE CLOSURE ACTIVITIES

A tentative schedule of progressive and final mine closure activities has been prepared for the period from 2013 to the end of the quarry life, which is as follows:

IMPLEMENTATION SCHEDULE FOR MINE CLOSURE (LIFE- 12 Years)

S.N	Activity	Year				
		Progressive Mine Closure Phase	Final Phase	Post Closure Phase		
		2 Nos. of 5 year periods covering 10 years of life	Last 2 years	PC1	PC2	PC3
A	**Dismantling of Structures**					
	Service Buildings	*****	*****			
	Residential Buildings	*****	*****			
	Industrial structures like CHP, Workshop, field sub-station etc.	*****	*****			
B	**Permanent Fencing of mine void and other dangerous area**					
	Random rubble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	#####	#####			
C	**Levelling & Grading of high wall slopes**					
D	**OB Dump Reclamation**					
	Handling/Dozing of OB Dump and backfilling					
	Technical and Bio-reclamation including plantation and post care					
E	**Landscaping**					
	Landscaping of open/cleared land for improving its esthetic					
F	**Plantation**					
	Plantation over cleared area obtained after dismantling					
	Plantation around the quarry area and in safety zone					
	Plantation over the external OB Dump					
G	**Environmental Monitoring / testing of parameters for 3 Yrs**					
	Air Quality	+++++	+++++			
	Water Quality	+++++	+++++			
H	**Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people**					
I	**Miscellaneous and other mitigative measures**					
J	**Supervision of mine closure activities**					

***** - **Whenever any structure gets redundant, it shall be demolished and freed area shall be reclaimed**

- **Whenever any void gets unused or any area becomes unsafe/dangerous, it shall appropriately fenced**

+++++ - **The environmental monitoring is obligatory as per the terms and conditions laid out in EC**

18.6 Abandonment Cost

At this juncture, it is difficult to reliably estimate the costs involved in execution of various mine closure activities in various phases of mine life. As required by the MOC guidelines, the details of the updated cost estimates for various mine closure activities shall be incorporated in the detailed final mine closure plan that shall be submitted to the MOC for approval at least 5 years prior to the intended final closure of the mine.

The mine closure rate as on Aug-09 was specified as **`6 lakh/Ha** for OC mines. The rate of mine closure revised as per the changed WPI in comparison to the base WPI of August-2009 has been considered.

Estimation of Mine Closure Cost

Total estimated mine closure cost as on Base Year

Particulars	**Relevant Data**
WPI Month	Mar-13
Total Project area (Ha)	1978 .00
Rate of mine closure cost (Lakh `/Ha)	7.898
Total estimated mine closure cost (`in Lakh)	15622.54

Annual Mine closure cost

Particulars	Relevant Data
Life of Mine from 2013-14(Years)	12
Considered life (Years)	12
Annual Mine Closure cost for 2013-14 (Lakh Rupees)	1301.88
Nth year AMCC (Lakh Rupees)	1301.88[1+0.05]^(N-1)
Total Mine Closure Cost (` in Crores)	207.22

Till 2018-19 Rs. 88.55 crores have been deposited to the Escrow A/C in first six installment.

Tentative Allocation of Mine Closure on Various Mine Closure Activities

The above estimated total mine closure costs in respect of Rajmahal OCP may be tentatively allocated on following MC activities (CMPDI norms):

Sl.	Item	Cost involved (Rs. in Lakh)
1.	Dismantling of industrial and residential structures	657.00
2.	Fencing of mine void and other dangerous area	311.00
3.	Handling/Dozing of OB dump into mine void and bioreclamation (including soil spreading, plantation and maintenance)	18455.00
4.	Grading of highwall slopes	367.00
5.	Landscaping	62.00
6.	Plantation	149.00
7.	Monitoring of environmental parameters	87.00
8.	Cost on supervision and execution of mine closure activities	166.00
9.	Miscellaneous and other mitigative measures	414.00
10.	Entrepreneurship development (vocational/skill development training for sustainable income of affected people	54.00
	Total Cost	**20722.00**

It may be noted that the above division of total cost has been made on the basis of a generalized norms for a typical OC mine and several projections made in respect of Rajmahal OC Project. Hence, these costs may vary at the time of execution of various mine closure activities and even some new activities may also be included.

ANNEXURE I

FINAL REPORT

On

DUMP SLOPE STABILITY STUDY FOR RAJMAHAL OCP

GODDA, JHARKHAND

June, 2018

By

DEPARTMENT OF MINING ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY
(BANARAS HINDU UNIVERSITY)
VARANASI 221 005
UP (INDIA)

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4.0 Conclusions

The stability for various sections of dump slopes in different conditions was carried out for Rajmahal Opencast mine. Finite element method has been used for analyzing the dump slope for different geo mining conditions. The factor of safety of 1.2 to 1.5 should be taken as short stability & Factor of safety > 1.5 for long term stability. However, due to previous accident in Rajmahal OCP and various uncertainties and discussion with competent authority and mine official, the

Factor of safety more than 2.5 has been considered as long term stability for the present study. The present scenario is termed as patch work profile. The conclusions and suggestion of the present study are summarized below.

- The factor of safety of patch work is varied from 1.09 to 2.7. It indicates that some of the section of the dump slope is short term stable. One can also observe that the cracks has initiated mainly in failed dump material.
- It is recommended that one can excavate the material from top to bottom. The failed material has very less shear strength and modulus of elasticity therefore the displacement is high and that has lead to crack generation in the dump material.
- It is observed that the slope is short term stable only at some sections. Therefore, it is advisable that during rainy season the proper drainage system should be adopted and precaution should be taken for patch work.
- The final designs are provided by the mine officials in terms of nine sections. The factor of safety has been calculated for various sections. The factor of safety is varied from 2.51 to 2.82. It indicates that the dump slope is stable for long term
- Dump slope do not fail without warning and may be managed through design of dump sequencing, re-sloping of selected areas. Regular monitoring of dump slope is also being advised. It is recommended that a qualified person to ensure that the dumps are constructed as specified by the design drawings.

- The monitoring program should include visual inspection of the dump slope, specially crest, slope face and toe areas for evidence of cracking, seepage, erosion, deformation etc. It is recommended that these areas be visually inspected by the shift supervisor or field engineer. Other observations (cracking, seepage, erosion, deformation) should also be logged properly.

- It has been observed that some cracks are visible on the surface of the dump. All these cracks must be filled and light weight material should be filled before rainy season. Monitoring should be done daily for strata movement.

5.0 Final Recommendations

- It is being recommended that the work must be done in two phases.
- In phase one the excavation of overburden dump should be done from top to bottom (i.e.124 MRL to -5 MRL). The RL of top of existing OB Dump is 124 mtr. & the insitu rock mass is at -5 MRL. It will be completely de-capped from 124 MRL to 64 MRL approx. The direction of advancement of working will be rise to dip.
- Phase one is bounded by grid 188600E to 189500E and 243600N to 244350N demarcated by red colour in **plan no ECL/RJML/OCP/DMZ/341 dated 04/05/2018 (Annexure 1)**. It is being recommended that the maximum height of dump should be 70m from insitu ground (expeted MRL -5) with maximum overall slope angle 15 degree. The bench height should be of 3m and width should be 9m in dump material.
- At this -5MRL, a 100 meter clear space from toe of dump should be left in in-situ which has been shown in plan & section attached (**ECL/RJML/OCP/DMZ/341 dated 04/05/2018**)
- The phase two will only start after completion of phase 1. In-situ excavation will be done in phase two. Phase two is bounded by grid 188600E to 189500E and 243600N to 244100N demarcated by green colour in plan no ECL/RJML/OCP/DMZ/341 dated 04/05/2018(Annexure 1). The overall slope angle should be 27 degree during working in in-situ rock benches. It is being recommended that the final overall slope angle should be 37 degree with bench height of 6m and width of 6m in in-situ strata.
- The fault will be exposed and rock mass near the fault can be observed during the excavation in insitu. It is likely that the rock mass near the fault is disturbed. Therefore, it is recommended that the rock mass near the fault must be observed during the excavation. If the rock mass is disturbed near the fault then the design of bench in terms of height and width shall be freshly carried out based on scientific study.
- It is being recommended that the fault plane should be excavated and removed through benching. The material of footwall side of fault F8 should be removed during excavation of overburden or coal.
- The monitoring program include visual inspection of the dump slope, specially crest, slope face and toe areas for evidence of cracking, seepage, erosion, deformation etc. It is recommended that the shift supervisor or field engineer visually inspect these areas. Other observations (cracking, seepage, erosion, deformation) should also be logged properly. Bench should have gradient in any direction for proper drainage.

- Continuous slope monitoring is essential to detect any instability in advance to safeguard against possible slope failure. The dump shall be regularly surveyed to produce up to date & accurate dump geometry.
- Adequate infrastructure to be provided for imparting training on slope stability to all concerned person employed in such large open cast mines.
- Technical competence of the contractual supervisors shall be appropriately scrutinized before deploying them in the mine.
- It is possible that any unfavourably oriented structural discontinuity (shear plane/fault/s) may be present in the mining area, which could not be detected during exploratory drilling and it is detected during ongoing excavation. It may create unsafe mining condition. The resident Geologist should conduct field mapping to see the existence of faults in the fresh exposure of the pit. It will help to detect the impending failure along these undetected weak planes.
- A few small-scale failures may subsequently cause a big failure. If two or three benches are made steeper at any level in any part/depth of the pit/dump then it may initiate failures. Although the overall slope angles may be quite low but the steeper slope angles of three benches may increase the stress at the toe of relatively steeper part of the slope, which may cause failures. Two or three such small failures may cause a big failure. So benching should be done properly from top to bottom.
- In case there are multiple fault planes, bench design should be such that they do not strike parallel to fault plane.
- Thus, it is strongly recommended to go for extensive monitoring of all the benches to detect any cracks development and its effect on the stability of benches.
- The monitoring stations should be installed at an interval of 50 meter on all benches in staggered manners so that effective gap between two stations of two immediate upper and lower benches would be 25 meters only.
- The Monitoring should be done daily for strata movement on daily basis. If there is detected any crack, deformation, movement in benches, it shall be immediately informed to higher management, if the symptoms are abnormal, it must be referred to ISO & DGMS authority and scientific agency and the work will be stopped till further instruction from Statutory bodies are obtained.

- **Implementation strategy**-- Mine management will comply all the recommendations as detailed above by IIT BHU in line with the plan & sections bearing no.**ECL/RJML/OCP/DMZ/341 dated 04/05/2018.**
- Further the working will be under the supervision of one Sr. Manager assisted by three under managers one in each relay/shift.
- Each shift under manager will be assisted by two supervisors. All of them will supervise the re-handing operation and ensure that ensure that working is done as per the recommendation & plan as mentioned above.
- The under manager/supervisors will inspect all the working area for dump slope, specially crest, slope face and toe areas for evidence of cracking, seepage, erosion, deformation etc. in the beginning of shift, middle of shift and end of the shift and hand over the charge to succeeding shift.
- One surveyor will ensure the supervision of strata movement by total station on daily basis by putting the target at every bench at a distance of 50meters in a staggered fashion.
- The mine manager will ensure every operation is being carried out as per the recommendations & plan and statutory provisions holistically.

Prof B K Shrivastva
(Principle Consultant)

Dr. Rajesh Rai
(Co-Consultant)

ANNEXURE II

भारत सरकार Government of India
श्रम एवं रोजगार मंत्रालय Ministry of Labour & Employment
खान सुरक्षा महानिदेशालय Directorate General of Mines Safety
पूर्वी अंचल, सीतारामपुर Eastern Zone, Sitarampur
****

संख्या एस3 /10375/II-B Resump.Work/2018/ 1138 सीतारामपुर, दिनांक 25/06/2018

प्रेषक / From
खान सुरक्षा निदेशक / Director of Mines Safety,
सीतारामपुर क्षेत्र संख्या–3/ Sitarampur Region No.3,
खान सुरक्षा महानिदेशालय, पूर्वी अंचल /
Directorate General of Mines Safety, Eastern Zone,
पोस्ट: सीतारामपुर, जिला: पश्चिम बर्द्धमान /
Post: Sitarampur, Dist: Paschim Burdwan, WB- 713359.

सेवा में / To
अभिकर्ता / Agent,
राजमहल ओ सी पी कोलियरी / Rajmahal OCP Colliery,
मेसर्स ईस्टर्न कोलफील्डस लिमिटेड / M/s Eastern Coalfields Ltd.,
पोस्ट: लालमाटिया / Post : Lalmatia,
जिला: गोड्डा, झारखण्ड / Dist : Godda, Jharkhand.

विषय: **Resumption of rescue and recovery work in Dahernangi Patch of Rajmahal OCP of M/s Eastern Coalfields Ltd.**

महोदय,

Please refer to your letter Nos. ECL/RJML/GM(OP)/557 dated 06.7.2017, RJML/GM(OP)/12/04 dated 03.4.2018, ECL/RJML/OCP/GM(OP.)/158 dated 21.5.2018 & ECL/Raj-OCP/262 dated 20.6.2018, on the above mentioned subject.

On perusal of the enclosed documents and plan & section No. ECL/RJML/OCP/DMZ/341 dated 04.5.2018 submitted along with the final report of IIT (BHU), Varanasi, I hereby permit you to resume rescue and recovery work in Dahernangi patch; subject to strict compliance of the following-

1. **All the recommendation given by IIT (BHU), Varanasi (at Para 5.0 of Page No. 36 to 37 of the final report) shall be strictly complied such as-**
   (i) It is being recommended that the work must be done in two phases.
   (ii) In phase one, the excavation of overburden dump should be done from top to bottom (124m RL to -5m RL). The RL of top of existing OB dump is 124m and in-situ rock mass is at -5m RL. It will be completely decapped from 124m RL to 64m RL approximately. The direction of advancement of workings shall be from rise to dip.
   (iii) Phase one is bounded by grid 188600E to 189500E and 243600N to 244350N demarcated by red colour in plan No.ECL/RJML/OCP/DMZ/341 dated 04.5.2018 (Annexure 1). It is being recommended that the maximum height of dump should be 70m from in-situ ground (expected MRL -5m) with maximum overall slope angle 15 degree. The bench height should be of 3m and width should be 9m in dump material.
   (iv) At this -5m RL, a 100m clear space from toe of dump should be left in in-situ which has been shown in plan and section attached (ECL/RJML/OCP/DMZ/341 dated 04.5.2018).

(v) The fault F8 shall be exposed and rock mass near the fault can be observed during excavation in in-situ. It is likely that the rock mass near the fault is disturbed. Therefore, it is recommended that the rock mass near the fault must be observed during the excavation. If rock mass is disturbed near the fault then the design of bench in terms of height and width shall be freshly carried out based on scientific study.

(vi) It is being recommended that the fault plane should be excavated and removed through benching. The material of footwall side of fault F8 should be removed during excavation of overburden or coal.

(vii) The monitoring plan include visual inspection of the dump slope, specially crest, slope face and toe areas for evidence of cracking, seepage, erosion, deformation etc. It is recommended that the shift supervisor or field engineer visually inspect these areas. Other observations (cracking, seepage, erosion, deformation) should also be logged properly. Bench should have gradient in any direction for proper drainage.

(viii) Continuous slope monitoring is essential to detect any instability in advance to safeguard against possible slope failure. The dump shall be regularly surveyed to produce up to date & accurate dump geometry.

(ix) Adequate infrastructure to be provided for imparting training on slope stability to all concerned persons employed in such large opencast mines.

(x) Technical competence of the contractual supervisors shall be appropriately scrutinized before deploying them in the mine.

(xi) It is possible that any unfavourably oriented structural discontinuity (shear plane/ faults) may be present in the mining area, which could not be detected during exploratory drilling and it is detected during ongoing excavation. It may create unsafe mining condition. The resident geologist should conduct field mapping to see the existence of faults in the fresh exposure of pit. It will help to detect the impending failure along these undetected weak planes.

(xii) A few small scale failures may subsequently cause a big failure. If two or three benches are made steeper at any level in any part/ depth of the pit/dump then it may initiate failures. Although the overall slope angles may be quite low but the steeper slope angles of three benches may increase the stress at the toe of relatively steeper part of the slope, which may cause failure. Two or three such failures may cause a big failure. So, benching should be done properly from top to bottom.

(xiii) In case there are multiple fault planes, bench design should be such that they do not strike parallel to fault plane.

(xiv) It is strongly recommended to go for extensive monitoring of all the benches to detect any crack development and its effect on the stability of benches.

(xv) The monitoring stations should be installed at an interval of 50m on all benches in staggered manners so that effective gap between two stations of two immediate upper and lower benches would be 25meters only.

(xvi) The monitoring should be done daily for strata movement on daily basis. If there is detected any crack, deformation, movement of benches, it should be immediately informed to higher management. If the symptoms abnormal, it must be referred to ISO & DGMS authority and scientific agency and the work shall be stopped till further instruction from statutory bodies are obtained.

2. The following strategies suggested by the IIT (BHU) shall be strictly implemented for strata monitoring (at para 5.0 of page No. 38 in the enclosed final report)-

(i) Mine management shall comply all the recommendations as detailed above by IIT, BHU in line with the plan and sections bearing ECL/RJML/OCP/DMZ/341 dated 04.5.2018.

(ii) Further the working will be under the supervision of one Sr. Manager assisted by three under managers one in each relay/shift.

(iii) Each shift under manager shall be assisted by two supervisors. All of them will supervise the re-handling operation and ensure that working is done as per the recommendation and plan & sections as mentioned above.

(iv) The under manager/supervisors will inspect all the working area for dump slope specially crest, slope face and toe areas for evidence of cracking, seepage, erosion, deformation etc. In the beginning, middle and end of each shift and hand over charge to succeeding shift.

(v) One surveyor will ensure the supervision of strata movement by total station on daily basis by putting the target at every bench at a distance of 50m in a staggered fashion.

(vi) The mine manager shall ensure every operation in being carried out as per the recommendations & plan and statutory provisions holistically.

(vii) A competent person should be deputed for making daily inspection of the area for sign of any new crack and/or widening of existing cracks.

3. In addition to the recommendations of the IIT(BHU), Varanasi, the following points are to be taken into consideration during the rescue and recovery work by re-handling of OB dump at Dahernangi patch of Rajmahal OCP -

(i) Proper drainage should be developed and benches should be properly levelled to avoid any entry of rainwater into the crack. No water shall be allowed to be stagnant at the toe of dump and top of the dump.

(ii) Any type of crack on the dump profile or mine profile should be monitored and examined.

(iii) There should be no cut in the toe of profile of dump/mine.

(iv) Rate of movement of dump should be monitored precisely and a record thereof shall be kept in each shift. The record of strata monitoring/ slope monitoring shall be signed and dated by the person making the inspection in each shift and shall be countersigned and dated by the patch incharge and manager on daily basis.

4. Sufficient numbers of statutory mine officials shall be appointed and provided in the Dahernangi patch for ensuring compliance with the recommendations of the IIT(BHU), Varanasi and monitoring of conditions as specified therein.

5. De-capping of overburden dump from the recommended 124m RL to 64m RL shall be done in a vertical slice of not more than 3m in such a way that while removing a particular slice from the top of OB dump, no man or machine shall be deployed in lower bench at that particular time. The direction of advancement of workings shall be from rise to dip side.

6. Workings shall be made in **"Phase One"** bounded by grid 188600E to 189500E and 243600N to 244350N demarcated by red colour in plan No.ECL/RJML/OCP/DMZ/341 dated 04.5.18. No workings shall be made in **"Phase Two"** to excavate in-situ strata in the area bounded by grid 188600E to 189500E and 243600N to 244100N marked by green colour in plan No. ECL/RJML/OCP/DMZ/341 dated 04.5.2018 unless a detail scientific study is done by IIT (BHU) and report thereof is submitted to this Directorate.

भवदीय,

25/6/18

(निरंजन कुमार)
खान सुरक्षा उपनिदेशक
कृते खान सुरक्षा निदेशक
सीतारामपुर क्षेत्र संख्या-3